LOCAL FOOD ASSESSMENT FOR YOLO AND SACRAMENTO DELTA COMMUNITIES

Prepared for:

Delta Protection Commission

Prepared by:

The Sacramento Area Council of Governments

In partnership with:

The Hatamiya Group

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A project of the Rural-Urban Connections Strategy (RUCS)

SACOG

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I. INTRODUCTION

The Sacramento-San Joaquin Delta sits at both at the geographic center of northern California's population centers and also as the major water distribution connection between northern California supply and demand south of the Delta. Within the Delta, farmers, business owners and other stakeholders benefit from a distinctive blend of cultural, recreational, natural and agricultural resources unique to the region. Yet in its position at the crossroads of the state, the Delta is also affected by a confluence of environmental, social and historical factors both internal and external to the area. Recognizing this unique role of the Delta to all Californians, the Delta Protection Commission's (DPC) mission is to "protect, maintain, enhance and enrich the overall quality of the Delta environment and economy" with a focus on agriculture, cultural resources, recreation and natural resources.

The Delta Protection Commission's 2030 strategic plan highlights the importance of agriculture in meeting the vision of a healthy, thriving Delta into the future, and lays out a number of objectives to protect and enhance the long-term viability of agricultural lands and operations. In this case study, the Sacramento Area Council of Governments (SACOG) and The Hatamiya Group have partnered with the Delta Protection Commission in deploying SACOG's Rural-Urban Connections Strategy (RUCS) to help answer questions about how to stimulate agricultural-based economic development in the Delta's rural communities in a manner that aligns with a shared vision of the Delta: "the ideal synthesis of cultural, ecological and agricultural values in a sustainable, healthy, and celebrated way of life."[1]

The DPC asked SACOG to focus the case study on a local food system assessment for Delta communities in Yolo and Sacramento Counties (the Delta counties that overlap with SACOG's planning jurisdiction). Agriculture in the study area—as in the larger state—is undergoing major changes as market forces, policy and environmental conditions shift. The RUCS toolkit helps not only describe how the current agricultural system is affected by these changes, but also to help envision strategies moving forward to preserve and enhance the long-term viability of agriculture in the Delta.

To begin to answer these questions, the case study starts by describing the unique role agriculture plays in the interdependent Delta ecosystem. To do so the study developed a field-level model of the study area drawing on data specific to the Delta, and then transitions to an investigation of emerging market opportunities to stimulate further economic development in Yolo and Sacramento County Delta communities. This review hones in on a leading opportunity for agriculture in the Delta: capitalizing on the ever increasing demand for local food by consumers in both the Sacramento and Bay Area metropolitan areas. Indeed, in terms of geography and natural resources, the Delta is well-positioned to expand its market share of supply to the nearly 10 million people constituting these markets.

Next, the case study delves into infrastructural barriers that could impede the expansion of the local food system in the Delta and conducts an in-depth financial analysis of expanding and creating new agricultural infrastructure through a food hub facility. Finally, the study constructs a series of possible near-term agricultural scenarios in the Delta to explore further strategies to support and accelerate local food system economic development.

[1] Delta Protection Commission, "Vision 2030: Delta Protection Commission Strategic Plan." http://www.delta.ca.gov/res/docs/Strategic_Plan/Vision_2030_FINALweb.pdf

Executive Summary

Current Agricultural Conditions

Agriculture is the centerpiece of the Delta economy and benefits from incredibly productive soil, a moderate climate, multi-generational knowhow and a prime location between major population centers in Northern California. The study delves into market opportunities in two of these regions specifically: greater Sacramento and the San Francisco Bay Area.

The case study area includes the portions of Yolo and Sacramento Counties within the legal Delta, encompassing 151,005 acres of agriculture production split between a variety of crops. The largest crops currently in production by acreage include alfalfa (31,881 acres, or a fifth of the study area), wine grapes (20,000 combined acres of white and red grapes) then corn, wheat and pears. By value the area's top agricultural commodities begin with wine grapes, followed by pears, alfalfa, tomatoes and cherries. Notably, the top twenty crops in the Delta study area account for 95 percent of agricultural value.

The gross value of this substantial agricultural output varies by year based on annual commodity prices. The study's modeling efforts estimate the value of agricultural production coming off Delta farms in Yolo and Sacramento Counties at around $300 million, not including the further substantial economic activity associated with the larger food system.

Emerging Market Opportunities

Agriculture in the Delta is well positioned to capitalize on the rapidly expanding demand for locally grown food, a sector that has witnessed nearly double digit percentage growth year over year. Likewise, consumer willingness to pay a price premium for local, source-identified food also continues to grow, and recent estimates have this price premium at around 20 percent from retail transactions. Even with substantial growth in the local market in prior years there is still substantial unmet capacity for expansion as individual households, restaurants, grocery stores, distributors, and institutions such as schools and hospitals across northern California continue to seek out locally-grown food.

The nearly 10 million residents of the Sacramento and Bay Area regions consume over 6.2 million tons (12.5 billion pounds) of food each year. Notably, over half of this consumption is for fruit and vegetables. Markets in these produce crops are particularly poised to benefit from increased local consumption trends. Households in metropolitan Sacramento spend over $6,700 each year for food; this figure rises to $8,400 in the Bay Area.

Barriers Growing for the Local Market

As a major agricultural economy, the greater Delta region has developed capacity for aggregation, processing, and distribution. Yet with the notable exception of the emerging cluster of activity around resident wineries, agricultural infrastructure in the Delta has closed or consolidated through time.

The lack of mid-scale facilities makes it difficult for individual growers to reach the scale needed to access the emerging local demand throughout the mega-region. Without this locally-serving infrastructure, produce distributors and wholesalers are challenged to source locally-grown produce at a cost-effective, consistent and reliable scale, instead often purchasing large amounts of produce from outside the region.

Strategies to Support the Local Food System: Delta-Serving Food Hub Model

Infrastructure encompassing aspects of aggregation, packing, processing, storage, marketing and distribution capacity—commonly referred to as food hubs—can help overcome the barriers farmers face in growing for local market demand. Likewise, a food hub can also begin to offer contracts to local growers for fresh produce, and, as it reaches scale, further processing to provide a shelf stable product for both local and export markets.

Drawing on the RUCS toolkit, the project team conducted an in-depth financial feasibility analysis of a food hub serving agricultural production in the portions of Sacramento and Yolo counties within the legal Delta. The food hub model developed in this work identifies crops currently or with the potential to be grown in the study area that respond to pronounced unmet demand, have a high ratio between purchase and sales prices, capture changes in food consumption trends, and allow for value-added activities and a year-round supply.

Overall the project team finds this food hub model serving Delta agriculture to be financially feasible for the hub operator and supplying farmer. Like many business start-up activities, the team's financial estimates suggest the facility would operate at a net loss during its initial years, as volumes are low and the operator incurs equipment and other capital costs. Yet as the food hub facility reaches adequate scale its cost structure shifts to a positive cash flow. At full capacity the Delta-serving food hub would generate revenue of over $16 million a year with an annual net positive cash flow of over $2.3 million to the hub operator. Notably, the food hub facility specified for this project provides a higher economic return than other facility cost analyses due to the unique crop mix supply of local agriculture. However, it is also important to note the considerable challenges in siting new infrastructure and development investments in the study area, due largely to flood protection regulations. Stakeholders must weigh potential financial returns against these challenges.

The project includes a pro forma toolkit as a separate Microsoft Excel workbook. This toolkit provides the detailed financial reporting of the business model while also allowing for customizable applications testing different crop supply, cost assumptions or market conditions.

Envisioning the Future: Delta Agriculture Scenarios

The case study conducts a range of agricultural scenarios to detail the magnitude of economic, environmental and other impacts from potential cropping pattern changes that respond to emerging market opportunities. The three identified scenarios—continuing recent trends, advancing a food hub investment, and supporting agritourism—demonstrate varying strategies to leverage the local food assessment for Yolo and Sacramento County Delta communities. The scenarios are constrained by market and environmental conditions to represent feasible near-term shifts (over a seven year timeframe) that respond to different policy and strategic goals. Together, the scenarios demonstrate possible strategies that Delta stakeholders may explore to accelerate growth in the local food system.

The first scenario measures the outcomes associated with the continuation of recent trends in cropping patterns over the last several years as farmers have responded to changing market conditions. The scenario shows some steady increases in study-wide economic indicators compared to the base case of existing conditions, illustrating the momentum in food system development through time.

The study's final two scenarios however—one encompassing an investment in a food hub facility, the other fostering increased agritourism—offer more proactive strategies to accelerate this economic growth for Delta farmers. Of the strategies modeled in this case study, the food hub scenario provides the highest net revenue and return on investment (ROI) for Delta growers. And with the highest overall gross returns, the agritourism scenario sheds light onto further possible strategies to support agricultural-based economic development. Both the food hub and agritourism scenarios also carry the potential to capture more economic value, not only on the farm, but in further value-adding activities within the larger food system. Yet the difficulty in siting infrastructure due to flood protection regulations may mean this off-farm activity is captured on the periphery or outside the study area.

All three scenarios result in a higher modeled level of farm labor demand compared to the existing conditions; this labor demand translates into potential jobs on Delta farms. The agritourism scenario leads the way in new on-farm labor, followed by the food hub and trend scenarios. While this increase in demand represents a job creation opportunity in the Delta, there are also serious challenges given the constrained nature of the agricultural labor market. In addition to the labor generated on the farm, the scenarios—especially the food hub and agritourism—also would lead to a greater diversity of off-farm employment opportunities, such as processing and distribution in the food hub scenario or commercial establishments supporting agritourism. Finally, the modeled outputs of the scenarios showcase the connection between higher agricultural values and jobs, and the need for a stable water supply. While the trend scenario would actually use less water than current conditions, the food hub and agritourism scenarios (the two with the highest economic and labor returns) would require slightly higher water usage in the agricultural system. However, the additional acre feet of water demand in the hub and tourism scenarios represents less than one tenth of one percent compared to existing conditions.

Conclusion

This case study's local food assessment for Yolo and Sacramento County Delta communities uses the RUCS toolkit to demonstrate the role of agriculture to the Delta economy, document emerging market opportunities for local agricultural producers, and explore possible strategies to accelerate economic growth and job creation in the local food system.

Overall, the study's analysis and scenarios show a range of strategies to stimulate food system development in a manner consistent with a shared vision for a healthy, sustainable Delta. Notably, the study provides indicators of the economic and other impacts as Delta farmers continue to expand on local market opportunities. The case study's trend scenario shows current food system momentum, while the food hub and agritourism scenarios demonstrate strategies to accelerate this trend and further activate the local market opportunity. All three scenarios are small-scale shifts constrained by market and environmental factors; as the strategies embodied by these scenarios grow through time, so too does the potential for further economic return and job creation. Yet while the strategies also provide for further economic activity off the farm, the difficulty in building new infrastructure in the Delta may mean this activity occurs farther along the supply chain, not on the farm. As such, the analysis and planning contained in the case study helps also provide connection to how Delta agriculture fits within the larger food system.

II. THE DELTA: A UNIQUE PLACE

The Sacramento-San Joaquin Delta is a working landscape, home to a wide diversity of plants and animals, some of which are unique to the region. Over time, this landscape has evolved into an oasis of rural beauty surrounded by high density urban populations and dotted with small towns serving as social and service centers for adjacent farms and recreational use. Settlement in the region has been and continues to be closely associated with the configuration of agricultural land and the rivers, sloughs, and waterways of the Delta. These rural communities reflect the diverse heritage and historical legacy of the Delta and include generations of farmers, business owners, and recreation providers. All of these aspects of the Delta are interconnected in a unique ecosystem − it is the environment that sustains the economy supporting the small towns and local businesses that draw the people who visit and recreate.[2]

Recognizing this unique ecosystem the California State legislature in September 1992 passed the Delta Protection Act (SB 1866), which declared the Delta as "a natural resource of statewide, national, and international significance, containing irreplaceable resources," and adopted policy to recognize, preserve and protect those resources of the delta for the use and enjoyment of current and future generations.[3] Additionally, this legislation created the Delta Protection Commission and instructed the establishment of a Land Use and Resource Management Plan (LURMP) for the Primary Zone of the Delta. The Delta Protection Act classified the land and water area within the boundaries of the Delta, as defined in the California Water Code, into "Primary" or "Secondary" zone designations.[4] The primary zone includes areas of primary state concern and statewide significance outside of a local government's sphere of influence and the secondary zone includes all of the remaining area within the boundaries of the Delta.[5]

In 2009 the Delta Reform Act was passed, and includes the co-equal goals of providing a more reliable water supply for California while protecting, restoring, and enhancing the Delta ecosystem in a manner upholding the unique cultural, recreational, natural resource, and agricultural values of the Delta. There are many challenges in implementing these critical, but often conflicting, goals. Since the Delta Protection Act was put into effect over two decades ago, development rates in the primary zone of the Delta have been more or less consistent with the provisions set in the LURMP, yet the secondary zone has seen development grow at a significant rate, increasing concern that such growth trends will further intensify strain on Delta resources and that impacts from development could spill over from the secondary to primary zone. Supporting statewide needs for land and freshwater by people and farms can also result in a decrease in overall water supply, adverse impacts to water quality, and a decline in fish populations. Yet the economic sustainability of Delta communities is inextricably linked to agriculture, which is dependent on water quality, and recreation such as boating and fishing, which require clean water and strong fish populations. As the state's population continues to grow, supporting

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[2] Ibid.
[3] Delta Protection Commission. "Delta Protection Commission: Committed to the Protection and Health of the Delta." State of California. Accessed 12 January 2016, http://www.delta.ca.gov/commission.htm.
[4] California Water Code, Part 4.5: "Sacramento-San Joaquin Delta", Chapter 2: "The Delta", Section 12220. Accessed 12 January 2016, http://www.leginfo.ca.gov/cgi-bin/displaycode?section=wat&group=12001-13000&file=12220.
[5] Ibid.

these needs will only continue to affect the Delta's habitat, agricultural, recreational, and business assets.

Ensuring that the Delta remains a healthy, viable ecosystem requires embracing the values that define the Delta as a unique place. Protecting and preserving agricultural land in production is a key element of this strategy, and the focus of this case study. Agriculture is the lifeblood of the local economy-supporting and preserving the heritage of local businesses and towns and positioning the region as a valuable asset to the state and nation. While open space and agriculture are often viewed as separate—and sometimes conflicting—land uses, the Delta Protection Act recognizes that the dedication and retention of agricultural land contributes to the preservation of open space and habitat (especially waterfowl on the Pacific Flyway).[6] By helping to preserve this open space, agricultural land also reinforces the Delta as a recreation and tourism destination. Thus, agricultural viability is fundamental to achieving the Delta Protection Commission's vision for creating the ideal synthesis of cultural, ecological, and agricultural values in a sustainable, healthy, and celebrated way of life.

Delta Agriculture and the Current Food System

As part of the Rural-Urban Connections Strategy (RUCS), SACOG has developed a suite of data and modeling tools to help answer questions about how to stimulate rural economic development and expand market opportunities for local agricultural producers. This case study applies these tools to the agricultural system in the portions of the primary and secondary zones of the legal Delta within southern Sacramento and Yolo counties (see Figure 1 below) to showcase agriculture's essential role in supporting the region's vision for a healthy, viable and unique Delta ecosystem. This case study geography includes the City of Isleton and portions of Elk Grove, Sacramento, and West Sacramento, as well as many smaller communities including Clarksburg, Courtland, Freeport, Hood, Locke, Ryde and Walnut Grove.

Agriculture in this study area benefits from incredibly productive soil, a moderate climate, and a prime location between major population centers in northern California. To document the current role of agriculture in the case study the project team employed a RUCS model drawing on data specific to the study area. Starting with SACOG's parcel level crop data, the model draws on satellite imagery and Pesticide Use Report data from the California Department of Pesticide Regulation, which is internationally recognized as one of the most comprehensive reporting systems. The model then inputs Cost and Return data published by the University of California Cooperative Extension by crop; these data serve as the authoritative source for the economics of agricultural production in the state. Together, this model provides data coverage for 97 percent of agricultural land in the study area (with the exception of ryegrass and cucumber production, for which recent Cost and Return data is not available). The resulting inventory is a highly detailed database of existing cropping patterns for the base year 2012. The case study's first appendix describes further the data sources and assumptions of the RUCS model.

As shown in Figure 2 below, the Sacramento-Yolo Delta study area currently encompasses 151,005 acres of agriculture in production. Table 1 summarizes the top 20 agricultural commodities by acreage, which account for 74 percent of the production acreage in the region. The top 10 crops alone total 66 percent of agricultural production in the Delta study area. Alfalfa makes up almost 21 percent of the study area, followed by white wine grapes (8%), corn (6%), wheat (6%), and red wine grapes (6%).

[6] Ibid.

Table 1. 2012 Top 20 Commodities by Acreage - Sacramento & Yolo County Delta

RANK	CROP	ACRES	PERCENT
1	Alfalfa	31,861	21%
2	Grapes - White Wine	11,444	8%
3	Corn - Grain	9,793	6%
4	Wheat	9,733	6%
5	Grapes - Red Wine	8,633	6%
6	Corn - Silage	8,264	5%
7	Pears - Green Bartlett	6,263	4%
8	Safflower	4,859	3%
9	Tomatoes - Processing	4,554	3%
10	Sunflower	3,903	3%
11	Rice	2,419	2%
12	Beans - Common Dried	2,386	2%
13	Rice - Wild	1,532	1%
14	Cherries	1,452	1%
15	Tomatoes - Fresh Market	1,451	1%
16	Timothygrass	1,450	1%
17	Oat Hay	719	0.5%
18	Sorghum - Grain	677	0.4%
19	Asparagus	438	0.3%
20	Small Farm Root Vegetables	330	0.2%

Note: This list does not include irrigated pasture.
Percent is of study area.
Source: SACOG, 2016.

Photo Credit: SACOG

Figure 1: Delta Primary and Secondary Zones

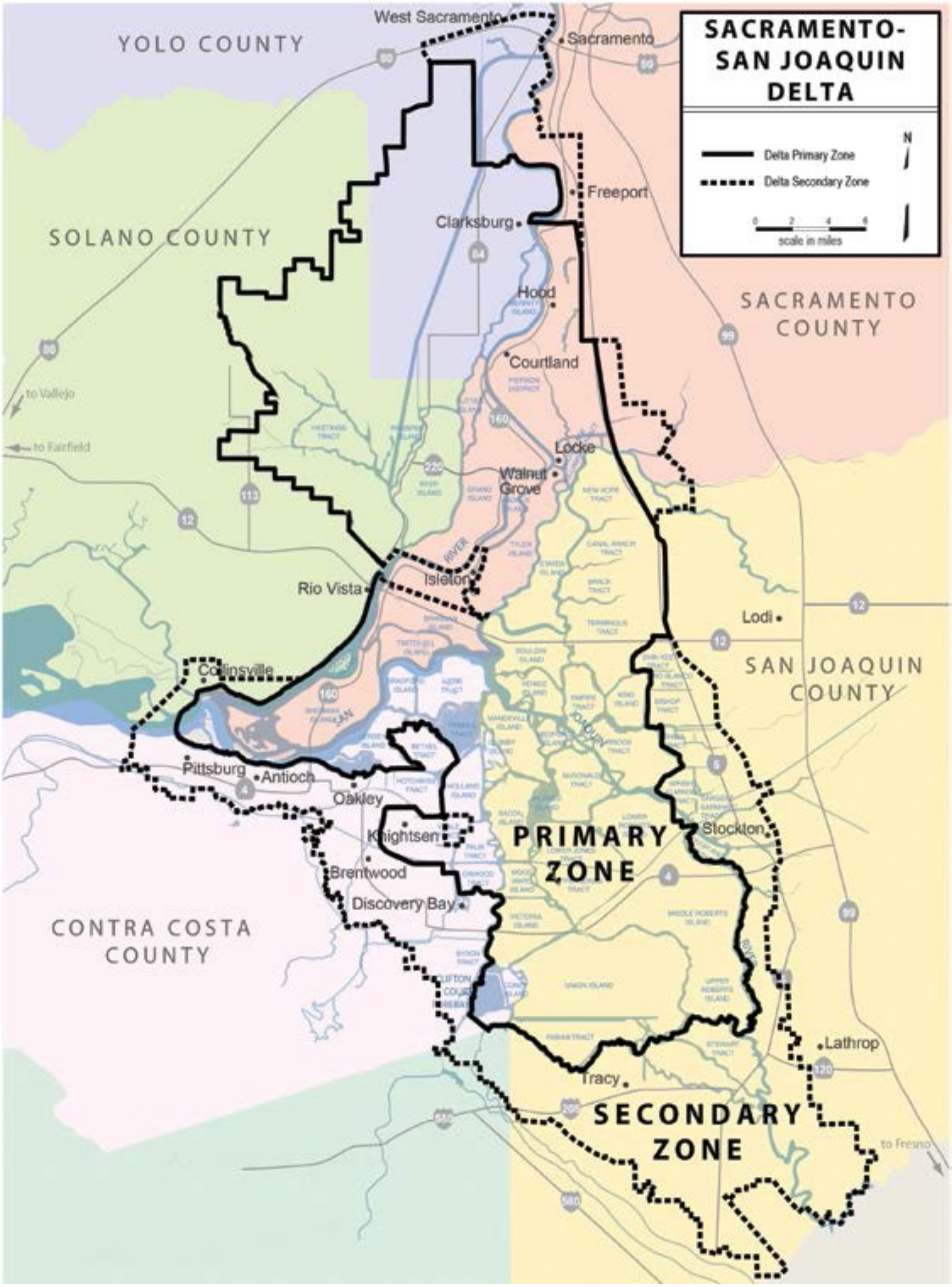
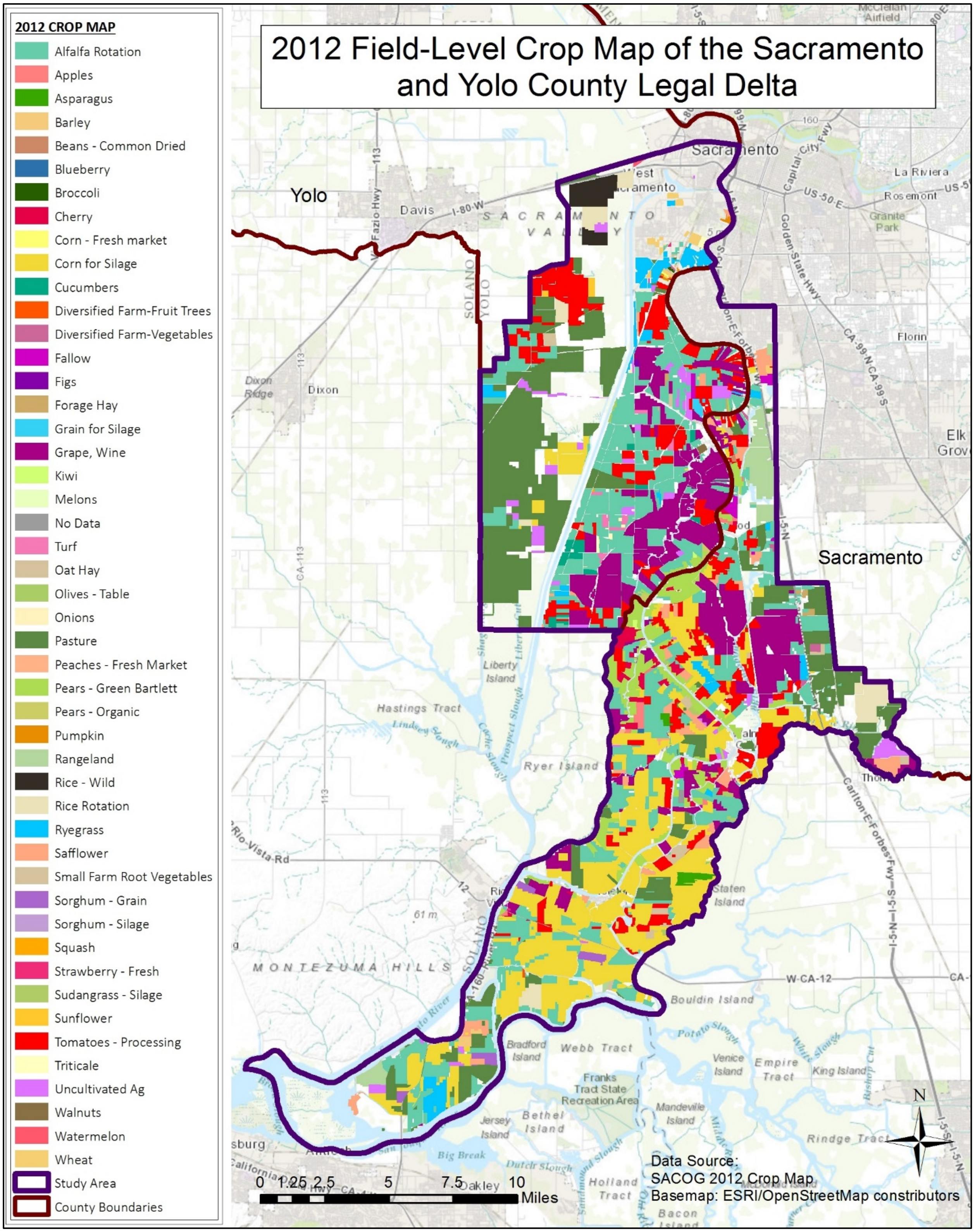


Figure 2: Existing Crops in the Sacramento-Yolo Delta



Taken together, the total crop acreage represents an annual value yield of almost $291 million in the base modeled year of 2012. Table 2 summarizes the top 20 agricultural commodities by value. These crops account for 95 percent of agricultural value in the region, while the top 10 crops alone represent 86 percent of Delta agricultural value. Many of the same crops with the largest acreage also have the highest total value, with the exception of oat hay and sorghum which drop off the list and are replaced by fresh apples, melons, and wild rice. Red wine grapes return 17 percent of value in the study area, followed by green Bartlett pears (14%), white wine grapes (13%), alfalfa (13%), and fresh market tomatoes (6%).

Table 2. 2012 Top 20 Commodities by Value* - Sacramento & Yolo County Delta

RANK	CROP	VALUE	PERCENTAGE
1	Grapes - Red Wine	$48,724,238	17%
2	Pears - Green Bartlett	$39,697,308	14%
3	Grapes - White Wine	$38,562,801	13%
4	Alfalfa	$38,000,104	13%
5	Tomatoes - Fresh Market	$16,682,018	6%
6	Cherries	$15,409,235	5%
7	Wheat	$14,090,068	5%
8	Tomatoes - Processing	$13,790,417	5%
9	Corn - Grain	$13,215,580	5%
10	Corn - Silage	$10,607,302	4%
11	Small Farm Root Vegetables	$5,238,498	2%
12	Rice	$3,733,790	1%
13	Apples - Fresh	$3,394,822	1%
14	Melons	$3,274,019	1%
15	Beans - Common Dried	$2,794,522	1%
16	Safflower	$2,695,733	1%
17	Asparagus	$2,275,801	1%
18	Timothygrass	$2,267,502	1%
19	Rice - Wild	$1,691,670	1%
20	Sunflower	$1,395,870	0.5%

**Value is based on a farmer's total gross returns and this list does not include irrigated pasture.*
Source: SACOG, 2016.

In addition to top level crop summaries, SACOG's RUCS Cost and Return model (see Appendix 1 for further detail) provides detailed metrics on per-acre quantity and cost data for production inputs such as water, labor, chemical, fuel, and irrigation, as well as operating costs, overhead costs, and establishment costs, to estimate the return and environmental indicators generated by a given crop mix. When aggregated to the study area level, the combination of these crop and economic data provide a powerful and comprehensive snapshot of the agricultural industry's contribution to the study region's economy and resource use. Table 3 below details a range of outputs generated by this model for the current agricultural system in the study area for the base modeled year. This current Delta crop mix yields estimated net revenues of $44 million, where field, vegetable, and fruit and nut crops provide a fairly even proportion of the net value. At over half the study area, field crops provide the highest yield and generate the most overall net revenue. To realize these yields field crops in the study area in aggregate use the most acre-inches of water and most water per ton yield; have the highest land, water, and fuel costs; and generate the most overall emissions from fuel use[7]. In comparison, vegetable crops have the lowest acreage currently in the study area, yet the average return on investment for these crops is higher than for field crop (22%) and fruit and nut crop (12%) mixtures currently grown in the study area. And on a per-acre basis the current mix of vegetable crops generates the highest gross returns and total net revenue, but uses more labor and produces more fuel-based emissions compared to the field crops grown today. Fruit and nut crops in the study's existing cropping mix have the highest labor and establishment costs per acre of any of the existing crop group mixtures, but with higher economic returns per acre similar to those seen by vegetable crops while using less water per acre. These outputs are based on the current crop mix in the study area, and will differ as the proportions within and between these cropping groups change. With all crop types taken together, the base case scenario of existing agricultural conditions in the study area includes over $246 million in associated annual costs, 3.3 million acre inches of water, and over 3 million hours of labor to yield almost 1.2 million tons of food valued at $291 million, with a return on investment of an estimated 18 percent.

Photo Credit: SACOG

[7] Per acre emissions in the study refer only to on-farm fuel use emissions, not other on-farm emission sources (such as nitrogen-based fertilizer) or off-farm fuel emissions associated with the crop production (such as external truck trips at harvest).

Table 3. 2012 Base Agricultural Conditions in Study Area (excluding pasture)

		Base Case Ag Production	Existing Delta Agriculture Production by Crop Type					
			Field Crops		Vegetable Crops		Fruit & Nut Crops	
Input	Acres	151,005	85,601	57%	7,013	5%	28,607	19%
Cost & Return Analysis	Total Costs	$246,479,251	$79,946,374	32%	$31,732,461	13%	$134,800,416	55%
	Total Gross Returns	$290,713,354	$97,366,174	33%	$42,572,897	15%	$150,774,282	52%
	Total Net Revenue	$44,234,102	$17,419,800	39%	$10,840,436	25%	$15,973,866	36%
	Average ROI	18%	22%	--	34%	--	12%	--
Costs Overview	Operating Costs	$166,644,334	$52,726,253	32%	$25,264,177	15%	$88,653,904	53%
	Cash Overhead Costs	$40,467,196	$17,164,266	42%	$4,122,803	10%	$19,180,127	47%
	Non-Cash Overhead Costs	$48,146,848	$14,235,050	30%	$3,227,585	7%	$30,684,213	64%
Dials	H2O (acre inches)	3,328,927	2,517,008	76%	217,766	7%	594,153	18%
	Labor (hrs)	3,042,659	436,891	14%	440,080	14%	2,165,688	71%
	Yield (tons)	1,148,829	655,218.6	57%	227,931.8	20%	265,678.8	23%
	Land Costs	$26,337,382	$12,537,586	48%	$2,646,313	10%	$11,153,483	42%
	Establishment Cost	$16,314,996	$3,147,606	19%	$287,739	2%	$12,879,652	79%
	H2O (cost)	$16,644,635	$12,585,041	76%	$1,088,828	7%	$2,970,765	18%
	Fuel (cost)	$10,135,291	$4,694,381	46%	$1,648,827	16%	$3,792,083	37%
Costs Details	Chemical	$17,054,421	$4,455,021	26%	$1,419,423	8%	$11,179,978	66%
	Contract	$34,803,313	$523,826	2%	$448,633	1%	$33,830,854	97%
	Custom	$33,953,232	$8,140,017	24%	$9,291,807	27%	$16,521,407	49%
	Equipment	$10,222,777	$4,877,642	48%	$1,330,951	13%	$4,014,185	39%
	Fertilizer	$18,647,174	$12,576,469	67%	$1,616,017	9%	$4,454,688	24%
	Fuel (non-adjusted cost)	$7,166,742	$2,825,278	39%	$1,450,308	20%	$2,891,155	40%
	Irrigation	$15,519,848	$10,609,360	68%	$1,701,851	11%	$3,208,637	21%
	Labor	$40,706,190	$6,679,461	16%	$6,336,271	16%	$27,690,458	68%
	Other	$438,365	$0	0%	$400,532	91%	$37,833	9%
	Pasture	$0	$0	--	$0	--	$0	--
	Seed	$5,394,707	$2,170,979	40%	$2,810,116	52%	$413,613	8%
Other Metrics	Farm Fuel CO2 Emissions (lbs)	52,981,023	24,352,583	46%	9,138,490	17%	19,489,950	37%
	Emissions/Acre (lbs)	351	284		1,303		351	
	Water/Acre (acre inch)	22	29		31		22	
	Yield/Acre (tons)	8	8		33		8	
	Water (acin)/Ton Yield	3	4		1		3	

III. OPPORTUNITIES IN DELTA AGRICULTURE: LOCAL FOOD

As the above section illustrates, agriculture plays a vital role in the local economy, producing a diversity of crops valued in the hundreds of millions of dollars a year while providing a positive return for Delta farmers. By capitalizing on emerging market opportunities, the area's agricultural sector is poised to stimulate even further economic development in local rural communities in a manner that continues to embrace the Delta's unique ecosystem and sense of place. As this section will illustrate, the ever-growing demand for local food represents perhaps the most notable emerging opportunity for agriculture in the region, especially as the Delta is well-positioned to capitalize on fast growing nearby markets. This study looks at two of these markets—the Sacramento and Bay Area metropolitan regions.

Across the nation, state and the region, public interest is increasing in not only how food is grown and produced, but where it is grown. Individual households, restaurants, grocery stores, fresh produce distributors, and institutions such as schools and hospitals continue to seek out locally-grown food. National consumer surveys and interviews compiled as part of this project highlight local and sustainably-produced foods as a major market trend. Indeed, a study by the Wallace Center found that the demand for local food is growing a rate of 9 percent per year nationally.[8]

This section focuses on the opportunities for Delta agriculture to meet expanding demand for local food. It begins by quantifying the substantial total food consumption by residents in the Bay Area and Sacramento regions, documents how these consumers are seeking to meet more of this demand through locally-sourced food, and concludes briefly with target crops grown or with the potential to be grown in the Delta that can tap into the rapidly growing demand.

Regional Food Consumption

The Delta sits between two of the nation's leaders in the shift to farm-to-fork consumption, metropolitan Sacramento and the Bay Area. The six-county Sacramento region includes a population of over 2.4 million people in El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba counties.[9] The nine-county Bay Area region includes over 7.5 million people in Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties. Together, the nearly 10 million residents in the northern California corridor constitute a major market for agricultural producers, processors and distributors.

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[8] Wallace Center, "Maintaining Values While Building Value," Third Biennial Food Hub Conference, March 30, 2016, Atlanta, Georgia.

[9] State of California, Department of Finance, E-1 Population Estimates for Cities, Counties and the State with Annual Percent Change — January 1, 2014 and 2015. Sacramento, California. Released May 2015. Accessed 23 November 2015 Available online at: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/view.php.

TOTAL FOOD CONSUMPTION IN THE SACRAMENTO REGION

SACOG's Regional Food Consumption Calculator demonstrates the significant total food consumption in the Sacramento region. The tool draws on data from the United States Department of Agriculture (USDA) Food Intakes Converted to Retail Commodities Database (FICRCD) and Loss Adjusted Food Availability (LAFA) series to estimate per capita consumption for individual foods and larger food groups.[10] The calculator reports in consumer tons, which is the weight of the food when purchased by the consumer (and is generally less than the farm or production weight of the crop, which includes stalks, leaves, etc.) Overall, the calculator shows an annual demand for almost 2 million tons of food in greater Sacramento. Notably more than half (56%) of regional total annual food consumption comes from fruits, nuts, and vegetables, the very crops that are seeing the most demand for local, source-identified production. On a per capita basis, Sacramento area residents consume 253 pounds of fruit and 365 pounds of vegetables each year.[11] Additionally, household food spending in the Sacramento-Roseville-Arden-Arcade metropolitan statistical area (MSA) is $6,721 annually and $5,619 annually in the Yuba City MSA.[12]

Table 4. Sacramento Region Food Consumption

ANNUAL TOTAL FOOD CONSUMPTION IN THE SACRAMENTO REGION, 2012	
Food Group	**SACOG Region**
Fruits	385,393
Vegetables	669,185
Nuts	5,968
Subtotal	**1,060,546**
All Other Foods	837,127
TOTAL tons	**1,897,673**

Source: SACOG Regional Food Consumption Calculator analysis of USDA's FICRCD and LAFA data bases. In consumer weight tons.

TOTAL FOOD CONSUMPTION IN THE BAY AREA

Each year residents in the Bay Area consumer over 4 million tons of food. Similar to the Sacramento region, half of total annual food consumption in the Bay Area (in consumer weight tons) comes from fruits, nuts, and vegetables. Yet given its larger population, this consumption amounts to more than double the demand in the Sacramento region (as shown in the table below). Regional annual food consumption totals approximately 238 pounds of fruit and nearly 340 pounds of vegetables per capita in

[10] The Food Consumption Calculator was developed utilizing the United States Department of Agriculture's Economic Research Service Commodity Consumption by Population Characteristics data series, which tracks the supply of commodities available for consumption in the United States and examines consumer food preferences, and the Food Intakes Converted to Retail Commodities Databases ("FICRCD"), which provide commodity content for food intake data as recorded in national dietary surveys. Loss ratios, as derived from USDA's Loss Adjusted Food Availability ("LAFA") dataset, were used to estimate primary and retail loss to calculate consumer weights.

[11] SACOG Regional Food Consumption Calculator analysis of USDA's FICRCD and LAFA data bases.

[12] United States Department of Labor, Bureau of Labor Statistics, "May 2015 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates", http://www.bls.gov/oes/current/oessrcma.htm. Consumer expenditure rates applied from the Consumer Expenditure Survey, 2014.

the Bay Area. Additionally, according to data from the Bureau of Labor Statistics, households in the Bay Area spend an average of $8,433 per year on food, which is significantly higher than the West regional average of $7,217 (including Washington, Oregon, Idaho, Nevada, California, Arizona, Alaska, and Hawaii) and that of the Sacramento region.[13]

Table 5. Bay Area Food Consumption

ANNUAL TOTAL FOOD CONSUMPTION BY THE BAY AREA REGION, 2014	
Food Group	**SACOG Region**
Fruits	893,751
Vegetables	1,275,521
Nuts	17,822
Subtotal	**2,187,094**
All Other Foods	2,190,295
TOTAL tons	**4,377,389**

Source: SACOG Regional Food Consumption Calculator analysis of USDA's FICRCD and LAFA data bases. In consumer weight tons.

Prospective Market Segments

Agriculture in the Delta has long served its nearby population centers. Yet through time agriculture in the Delta and across the country has evolved into larger, highly centralized systems. Like the rest of the nation, the vast majority of the 6 million tons of food consumed each year between residents of the San Francisco and Sacramento metropolitan regions is grown outside the region, moving through a concentrated and specialized food system that takes advantage of scale to provide an inexpensive and consistent product, yet loses source identification and freshness.

As mentioned above, market actors from individual households to large institutions are seeking an alternative to the dominant food system that substitutes scale and consistency for source-identified, fresh, locally grown food. The metropolitan regions surrounding the Delta are leaders in this trend. Overall the local food market is growing at nearly 10 percent year over year, leading to more opportunities for growers. In addition to demanding more local food in aggregate, consumers are also increasingly willing to pay more for this fresh, source-identified product, up to an estimated 20 percent local market premium in retail transactions.[14]

In short, together there are approximately 10 million people residing in the Sacramento and Bay Area regions that consume around 4.5 million tons of fruit and vegetables each year, plus several million tons of other food products. Of this massive consumption, consumer demand for locally grown, source-identified, healthy and sustainably-produced food is growing rapidly, especially for fresh produce, representing a significant market opportunity for Delta agriculture. This trend is evident in the increasing popularity of farmers' markets and Community Supported Agriculture in both regions. Likewise, major

[13] Bureau of Labor Statistics, United States Department of Labor, "Selected western metropolitan statistical areas: Average annual expenditures and characteristics, Consumer Expenditure Survey, 2011-2012," January 9, 2014. http://www.bls.gov/cex/csxmsa.htm.

[14] Wallace Center, "Maintaining Values While Building Value," Third Biennial Food Hub Conference, March 30, 2016, Atlanta, Georgia.

companies and institutions in the region are increasingly looking to source locally. Businesses all along the distribution chain, from farmer to retailer, have begun to provide sourcing information and create a "value-based food supply chain." For example, some local grocery stores like Diablo Foods, Raley's and Whole Foods provide customers with farm-identification in their produce section and advertise their "buy local" policy. Bay Cities Produce provides their institutional customers like hospitals and schools with source-identified produce and washed-and-cut produce mixes. Wholesale suppliers, such as Produce Express, are expanding deliveries of locally grown produce to restaurants throughout their service area, and Whole Foods Market and large grocery stores have started selling local produce in their stores. A prime example of a local farm-to-institution effort is the Davis Farm-to-School Connection, whose comprehensive program includes: local purchasing for school meals, school gardens, nutrition and food education, farm tours, and recycling and composting programs. In addition, California State University, Sacramento has implemented a Sustainable Food Policy that requires at least 20 percent of campus food spending on products from local farms; the University of California, Davis has a similar policy. Similarly, the Sacramento Kings have pledged to source 90 percent of food and beverages served at the Golden 1 Center arena from within 150 miles of downtown Sacramento.

Table 6. Sacramento Region Illustrative Production and Consumption

FOR TARGET SPECIALTY CROPS, 2012		
Target Crop	**Acres in Production**	**Acres Needed to Meet Regional Consumption**
Apples	1,723	8,129
Apricots	118	225
Asparagus	63	1,721
Bell Peppers	32	323
Blackberries	102	10
Blueberries	92	570
Broccoli	56	1,497
Carrots	17	940
Celery	7	167
Chili Peppers	144	258
Eggplant	84	79
Kale	10	307
Lettuce (all)	83	2,755
Onions	222	1,028
Raspberries	14	47
Spinach	23	522
Squash	606	729
Strawberries	123	781
Sweet Potatoes/Yams	2	770
TOTAL	**3,519**	**20,858**

Sources: *For production*- 2012 USDA Census of Agriculture
For consumption- SACOG food calculator and USDA National Agricultural Statistics Service (NASS) 8 year CA average yields per ton

Even with substantial growth in the local market in prior years there is still substantial unmet capacity for expansion. Early RUCS estimates suggested that less than 2 percent of food consumed in the Sacramento region was grown in the region, though that percentage has likely grown somewhat through time. In addition to aggregate estimates, the RUCS toolkit also showcases the supply/demand gap for target fresh fruit and vegetable crops in the region, helping hone in on further market opportunities. Table 6 above shows existing acres of production of select crops in the Sacramento region compared to the acres of production that would be needed to meet regional consumption levels, calling attention to the existing gap. Likewise, Table 7 below documents the current consumption of select fresh specialty crops in the Bay Area. The project's market analysis deliverable found these crops respond to a pronounced market gap in the region while the modeling and agricultural economic review suggest these crops are currently grown or have the potential of being grown in the Delta to meet local food demand.

Table 7. Bay Area Market Opportunities

BAY AREA CONSUMPTION OF TARGET LOCAL CROPS FOR DELTA AGRICULTURE, 2014		
Target Crop	**Pounds Consumed per Individual**	**Tons Consumed Across Bay Area Region**
Apples	13.6	50,915
Cherries	1.2	4,327
Pears	2.5	9,497
Peaches	3.8	14,136
Blueberries	1.1	4,124
Strawberries	6.1	23,025
Iceberg Lettuce	13.2	49,474
Green leaf Lettuce Red Leaf Lettuce Romaine Lettuce	8.6	32,233
Spinach	1.4	5,215
Broccoli	5.6	21,019
Kale	0.2	667
Tomatoes	15.5	58,381
Bell Peppers	9.0	33,682
Celery	5.2	19,533
Carrots	7.0	26,092
Potatoes	30.6	114,824
Sweet Potatoes	5.5	20,619
Onions	16.1	60,612
TOTAL	**--**	**548,375**

Source: SACOG Regional Food Consumption Calculator analysis of USDA's FICRCD and LAFA data bases.

IV. BARRIERS TO GROWING FOR THE LOCAL MARKET

Despite the significant local market opportunity for Delta agriculture highlighted above, there are several important barriers to growing in a locally-oriented agricultural system. If unaddressed, these barriers can inhibit recent momentum and hinder market growth. These interrelated challenges have been articulated by a variety of rural stakeholders and provided the launching point for SACOG's RUCS program. Notably, regional stakeholder outreach revealed the lack of infrastructure as a leading impediment to the expansion of a locally-serving agricultural sector.

Operating Infrastructure

As a major agricultural economy, the greater Delta region has developed capacity for aggregation, processing, and distribution. There are operational and vertically-integrated agricultural facilities in the study area capable of handling commodities such as pears, apples, cherries and kiwis. Based on stakeholder interviews and a review of California Department of Public Health registrations, there are no facilities within the Delta portion of Sacramento or Yolo counties that meet the California Department of Public Health's definition of food processing (outside of wineries).[15] Yet there are seven packing, cold storage, and aggregation facilities in the region, all located in the Delta portion of Sacramento County. Only one of these facilities, River Road Exchange, is not currently operational. Table 8 below includes the existing major non-winery agricultural infrastructure within the Sacramento-Yolo Delta, as identified by stakeholders and confirmed as part of this study, listed by geographic location from north to south.

The evolution of "Clarksburg Wine Country," a designation in Yolo County created by the Clarksburg Wine Growers and Vintners Association, is one aspect of agricultural infrastructure that is undergoing a continued renaissance. The Clarksburg appellation is home to some of California's premiere wine grapes. With more than 35 varietals, the region is now recognized statewide and beyond for consistently delivering quality grapes and wines. The area is also located just 30 minutes outside of the state capitol as a convenient tourism opportunity. The growth in demand for locally-produced wines has fueled the expansion of Delta micro-wineries and the emergence of associated agritourism. More recent facility projects− such as the conversion and reutilization of The Old Sugar Mill, a shuttered beet sugar processing facility, into a major multiple winery facility− have injected new energy into the area and present an opportunity for an increased wines presence in the Clarksburg appellation. In addition, the expansive growth of the Bogle Family Winery led to the development of a larger facility just southwest of Clarksburg.

[15] California Department of Public Health, Food and Drug Branch, "Processed Food Registration", accessed May 4, 2016, from https://www.cdph.ca.gov/programs/Pages/FDB%20ProcessedFoods.aspx.

Table 8. Agricultural Infrastructure in the Delta Study Region

Facility Name	*Type of Facility*	*Location*
Operational Facilities		
Green & Hemly	Packing, cold storage, and aggregation of fresh pears, apples, cherries and kiwis	11275 State Highway 160 Courtland, CA
David Elliott & Sons/Stillwater Orchards	Packing, cold storage, and aggregation of fresh pears, cherries and kiwis	11845 Randall Island Road Courtland, CA
Rivermaid Trading Company	Cold storage of fresh pears (decommissioned packing lines-formerly Steamboat Orchards)	15229 Grand Island Road Walnut Grove, CA
Rivermaid Trading Company	Packing of fresh pears	Andrus Island Road Walnut Grove, CA
Perez & Sons	Trucking facility, mini-packing sheds	Twin Cities and River Roads Walnut Grove, CA
Riverside Elevators	Grain storage and silos for field corn, winter wheat, oats and rye grass	14712 State Highway 160 Isleton, CA
Non-operational Facilities		
River Road Exchange	Formerly cold storage, packing shed. Proposed reuse for micro-wineries, micro-breweries, weddings, etc.	10724 River Road Hood, CA

Yet with the notable exception of the emerging cluster of activity around resident wineries, the project's aggregation and processing infrastructure inventory found existing agricultural infrastructure in the Delta to have closed or consolidated through time.[16] Furthermore, the area's existing agricultural infrastructure tends to be oriented towards consolidation and centralization of large production crops generally exported out of the region. In short, this project has identified a lack of mid-scale produce handling and processing capacity as a gap in building out the local food system. [17]

In contrast, the study's market demand assessment identified ever growing demand and opportunities for expanding the local market sector. The lack of mid-scale facilities makes it difficult for individual growers to access the emerging demand, and for Delta growers in aggregate to realize the economies of scale needed to enter the large markets of the nearby population centers. Under current conditions, Delta growers (aside from small vineyards and wineries) interested in value-added processing and handling of their agricultural crop production must look to areas outside the Delta for potential

[16] SACOG and The Hatamiya Group, "Local Food System Assessment for Yolo and Sacramento County Delta Communities: Market Analysis." Prepared for the Delta Protection Commission, November 2015.
[17] This finding is based on available data supplemented with a review of key stakeholders in the region including County Agricultural Commissioners and staff; the California League of Food Processors; Sacramento and Yolo County Farm Bureaus; University of California Cooperative Extension; and leading growers and farmers across the region.

processing and aggregation facilities. Consumers tend to value locally-grown food for its perceived freshness, yet the lack of corresponding agricultural infrastructure makes it more difficult to remove crop field heat and thus optimize freshness, reduce food waste, and extend shelf life.[18]

Market Challenges

Likewise, without supporting infrastructure—and unlike in commodity agriculture geared towards large domestic and international markets—growers focused on emerging markets may seldom be provided a contract, and thus the security of a guaranteed outlet for their product. The strength of the current national and international commodity system may also be a disincentive for many producers considering expansion into local production.

Similarly, initial evidence suggests that direct-to-consumer channels such as farmers markets and community supported agriculture (CSAs) may be reaching saturation.[19] Reaching larger markets, such as wholesale, requires corresponding infrastructure, especially at regional institutions such as hospitals or schools with complex procurement policies. To this end, a survey of 70 local farmers found operating costs and infrastructure to be the top challenge in growing for the local market.[20]

The dearth of locally serving agriculture infrastructure is compounded as any new developments or expansion of existing facilities face increasing mandates and regulations that are costly, time consuming, and difficult to fulfill. Building new agricultural infrastructure or refurbishing existing agricultural facilities in the Sacramento-Yolo Delta has become increasingly more difficult over time. For example, in order for the Old Sugar Mill to meet current California earthquake standards its entire internal structure needed to be reinforced with costly steel beams and standards. This requirement can make it too expensive to retrofit existing structures built during the 20th century.

Since the advent of Hurricane Katrina in New Orleans, the Federal Emergency Management Agency (FEMA) has redefined its flood zone designations for the entire nation. As a result, flood zone designations within the Delta region and along California levees have become more stringent, making building and expansion more difficult and cost prohibitive. Moreover, discussions with Yolo and Sacramento County Farm Bureau Officials and Delta growers suggest that building, environmental, and air and water quality regulations have become more burdensome. The most recent limited additions to

[18] Removal of field heat (or 'pre-cooling') describes the post-harvest, pre-storage treatment process through which agricultural producers cool recently harvested produce in an effort to increase storage life, through a variety of techniques, such as forced air cooling, hydro-cooling, etc. Crops that are left at a higher holding temperature experience more rapid respiration and transpiration rates, which will cause the quality to degrade, and can lead to shorter shelf life, rotting, shriveling, and/or spoilage. Therefore, generally the faster produce is cooled postharvest, the longer its shelf-life will be. This applies predominantly to fruits and vegetables, with varying levels of susceptibility between crops.

Biological and Agricultural Engineering, NCSU. "Postharvest Cooling and Handling of Apples". NC Agricultural Extension Service. Accessed 14 January 2016. Available online at: http://www.bae.ncsu.edu/programs/extension/publicat/postharv/ag-413-1/

FAO. "Ch. 8: Storage of Fresh Produce" *Production is Only Half the Battle,* 1988. Accessed 14 January 2016. Available online at: http://www.fao.org/wairdocs/x5014e/X5014e0a.htm

[19] Sacramento Area Council of Governments, Rural Urban Connections Strategy. "Impediments to Supplying Locally Grown Specialty Crops." Sacramento Regional Agricultural Infrastructure Project, July 2014. Available at http://sacog.org/rucs/pdf/Impediments%20to%20Supplying%20Locally%20Grown%20Specialty%20Crops.pdf

[20] Ibid.

agricultural infrastructure within the Delta region, the Bogle Winery expansion in Yolo County and David Elliott & Sons cold storage expansion in Sacramento County, were both approved and built before these more stringent regulations were put into place.[21]

Without this locally-serving infrastructure, produce distributors and wholesalers are challenged to source locally-grown produce at a cost-effective, consistent and reliable scale, instead often purchasing large amounts of produce from outside the region.

Infrastructure Investments

While there can be significant barriers in growing for the local market, many can be overcome through infrastructure investments that cut down on operating costs, coordinate supply chains that improve market access and reduce labor requirements. In particular, infrastructure encompassing aspects of aggregation, packing, processing, storage, marketing and distribution capacity can help overcome the barriers farmers face in growing for the local market. Therefore, the strong demand for fresh specialty crops within the Bay Area and Sacramento regions could potentially be met with increased and diversified production within the Delta, especially in light of the growing consumer demand for locally grown fresh products. This is driving the need for and interest in creating food hubs to aggregate and process food in greater volumes to serve these markets. A hub facility would also help capture more of the associated economic activity within the region, as more value-added processing, marketing, and distribution take place in the Delta rather than outside of it. These food hubs can also begin to offer contracts to local growers for fresh produce, and, as they reach scale, further processing to provide a shelf stable product for both local and export markets. The subsequent section of the study delves into what a food hub could look like in the Delta, and the financial feasibility of such an investment.

Photo Credit: MrMitch, Creative Commons

[21] This finding is based on available data supplemented with a review of key stakeholders in the region including County Agricultural Commissioners and staff; the California League of Food Processors; Sacramento and Yolo County Farm Bureaus; University of California Cooperative Extension; and leading growers and farmers across the region.

V. DELTA FOOD HUB MODEL

With a longstanding heritage of agricultural knowhow and proximity to ever-increasing demand for local food in nearby population centers, Delta farmers in the project's study area are poised to leverage growth in the local food system as economic development and expanded market opportunities. As the above section demonstrates, however, the region and the Delta face key challenges in scaling a more locally-oriented food system. In particular, new developments or expansion of existing facilities in the area are constrained by flood protection and other regulations, yet stakeholders identified the lack of mid-scale agricultural infrastructure as a major impediment to the expansion of the local market sector.

This section delves into the feasibility of expanding locally-serving agricultural infrastructure through investment in a **food hub**, one possible strategy to support growth in the local food system. The analysis provides financial performance indicators for the hub while recognizing there are limitations on where the facility could locate. In this food hub feasibility assessment we:

- Explain how food hubs help address key challenges in building out the local food system
- Develop a food hub business model specific to the Delta study area
- Conduct an in-depth financial analysis of the project's Delta food hub model
- Perform a crop production analysis of farmers growing for the food hub model

The report's financial feasibility user guide—included as the third appendix to this case study—provides detailed coverage of the Delta-specific food hub model as well as a walkthrough on how to read and customize the project's pro forma tool kit. The detailed pro forma tool kit is included in this case study as a separate Microsoft Excel spreadsheet.

Food Hub Functions

Mid-scale infrastructure encompassing aspects of aggregation, packing, processing, storage, marketing and distribution capacity respond to key barriers in growing for the local market. This infrastructure—forming what many call food hubs— can also begin to offer contracts to local growers for fresh produce, and, as it reaches scale, further processing to provide a shelf stable product for both local and export markets. Furthermore, food hubs help create new market channels between local growers and consumers, helping connect source-identified food to rapidly growing demand. National research and local stakeholder engagement shows how these functions provide an essential "middle" infrastructure for supply chains as local food systems scale from niche markets towards more broad market penetration.[22]

In reviewing food hub functions the project team drew on the robust national best practice contained in SACOG's *Sacramento Region Agricultural Infrastructure Project*. These resources show how the food hub movement is growing rapidly across the nation as a strategy to support and strengthen local and

[22] Applied Development Economics, Inc., Foodpro International, Inc., The Hatamiya Group, DH Consulting and Sacramento Area Council of Governments, "Research Analysis of Food Hub Trends and Characteristics." *Sacramento Regional Agricultural Infrastructure Project*, August 2014.

regional food systems, yet the varied examples of hubs currently in operation across the country speak to a diverse profile of potential food hub business models and functions. The project team used these best practice resources in conjunction with the local supply and market review to determine the type and amount of investment needed to advance a food system in the Delta oriented toward local market demand opportunities. To do so, the team developed a business and corresponding financial food hub model specific to the Delta study area. The components of this project-specific food hub model are explored in turn.

Delta Study Area Food Hub Model

CROP SUPPLY

The project team's first step in creating a food hub model specific to the study area was to translate the supply and demand analysis (described in the third section of this report) into target crops that could supply a food hub facility. The Delta-specific food hub model developed for this project is scoped to serve as a market outlet for Delta agricultural products either currently grown or with good potential to be grown in the study area that respond to emerging local market opportunities. In particular, the project demand estimates reveal a strong preference and rising demand for fresh specialty crops in both the San Francisco and Sacramento markets, including many Delta-grown fruits and vegetables. The demand estimates also call attention to crops not currently grown at scale in the Delta, but with potential to be grown in response to changing consumer demand and food consumption patterns.

That worked has identified a set of target crops to supply the Delta-serving food hub model. In addition to unmet demand and the feasibility of growing the target crops in the study area, each crop was analyzed by the ratio between purchase and sales prices; potential for value-added activities; the need to have a year-round supply to the hub; and, to capture innovations in food consumption trends.

Table 9. Target Delta Crops to Supply Food Hub Facility

Lettuces (various)	Tomatoes	Pears	Potatoes
Spinach	Bell Peppers	Peaches	Sweet Potatoes
Kale	Strawberries, blueberries, raspberries	Celery	Onions
Broccoli	Apples	Carrots	

These target crops serve as an important input in the project's financial feasibility assessment. As described below and in this report's third appendix, users can also perform customized analysis in the project's pro forma toolkit to test alternative crop mixes.

FOOD HUB VALUE-ADDING ACTIVITIES

A review of food hubs currently in operation across the country finds a diverse array of value-adding activities, ranging from core hub functions in aggregation, packing, storing and distributing to more expansive efforts such as grower GAP (Good Agricultural Practices) certification or business incubation.

Generally the more expansive business service activities are incorporated after the hub has been established and has developed relationships with growers through time. As such, in developing an initial food hub model for the Delta study area, the project team focused on the core hub activities of aggregating, packing, storing and distributing locally grown food at a scale to reach larger markets. The team did not include additional hub functions around grower or business services as a revenue stream in the model, but did include a line item in the pro forma to measure these potential revenue-generating activities in future applications of the tool.

A unique element compared to national models that the project team did add to the Delta food hub business model was light processing, which diversifies and extends product shelf life. Processing is a key value-adding component of the food system, yet the region has lost much of its larger processing activity through time. Recent trends suggest the opportunity for more mid-scale processing to capture locally more of the total food system value. Including processing in the business model responds to these trends and tests the financial feasibility of this value-adding activity in the study area.

FOOD HUB BUSINESS MODEL

To meet the proposed functions and crop supply scoped for the study area, the project team honed in on a for-profit business model for a Delta-serving regional food hub. The project team considered a number of important factors in reaching this conclusion. Notably, many nonprofit hubs across the country do not operate at the scale envisioned for this hub, and face difficulty achieving the needed level of private capital investment.

The following food hub pro forma financial analysis tests this business model on actual 2014 wholesale commodity price data for crops grown in northern California and sold into the San Francisco Bay Area market. The work uses the Agricultural Market Service's (AMS) Market News data series from the US Department of Agriculture, at both the Shipping Point (as a proxy for farmgate) and Terminal Market (as a proxy for wholesale) locations. The prices are reported for typical shipping containers and can vary across individual farmers to some extent. The hub's price structure is explained further in the pro forma user guide found in the appendix.

By using wholesale prices and basic levels of hub services, the subsequent financial feasibility analysis takes a conservative approach in estimating the facility's profitability. As the hub is viable at this level of operation and price structure, it will have the opportunity to generate higher levels of revenue and return with more value-adding activities (such as providing liability insurance or certification training), with products that command a premium and by targeting additional markets (such as direct-to-consumer).

PHASING ANALYSIS

As with any business, the food hub model developed for the Delta study plans for several phases of growth, from start up to full utilization. The corresponding financial feasibility analysis also incorporates this phasing to show how the facility performs through time. The phasing analysis aligns with the conservative approach employed in the project's cost structure, as the facility gradually establishes its market niche and builds relationships with local growers. Recent longitudinal research of over 350 hubs shows a 90 percent survival rate nationally, yet several prominent examples of hub closure speak to the risk involved in the startup activity. Recent research points to inexperienced hub management and the inability to recruit farmers to provide a consistent, reliable supply as key factors in hub closure.[23] As shown below, a phased approach over seven years would allow a reasonable entry point into the Delta food system and time for the hub operator to build market relationships and capacity with local Delta growers.

Table 10. Food Hub Phasing Plan

Phase I *Year 1: Start-Up*	The operation locates within an existing facility, incubating with an existing partner if possible, with 2 limited sorting and packing production lines
Phase II *Years 2-3: Scaling Up*	One to two years of growth in a leased facility as the hub scales up operations for aggregation, sorting, packing, storing, packaging and distribution of fresh produce
Phase III *Years 4-5: Stabilization*	The hub moves into its own 22,000 square foot facility and adds processing functions, gaining the ability to sell consistently to larger institutional buyers, with a stabilized level of operation on 2 production lines and initial processing activities on a third line
Phase IV *Years 6-7: Full Capacity*	The facility reaches full capacity, with three production lines during Year 6, and expanding in Year 7 with four production lines as the market grows for the hub's services and products and more processing equipment is added

DELTA FOOD HUB MODEL SUMMARY

The project team created a food hub business model specific to the study area, drawing on local supply and demand data along with national best practice in food hub operations. The envisioned food hub model performs the core aggregation, packing, storage and distribution capacity that connects local Delta growers to rapidly growing demand for fresh food in nearby metropolitan areas. The food hub model developed for the project also incorporates light processing functions that add value to locally-grown food. As the hub develops through time to build relationships with local growers it can add further revenue streams from certifications, training and other functions.

To meet the scale of operations envisioned for the facility, the project team identified a for-profit business model to serve distributors, wholesalers, institutions and other market actors seeking an increased supply of locally-grown food. As such, the hub financial analysis operates under wholesale prices, using current AMS data on what farmers in northern California are paid for target crops, and the price paid for these crops at terminal wholesale markets in the Bay Area.

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[23] Jim Barham, USDA Rural Development, "Why Food Hubs Fail." Plenary panel at Third Biennial Foo Hub Conference. Atlanta, Georgia. Thursday March 31, 2016.

Financial Feasibility Analysis

To test the financial feasibility of the project's food hub business model, the project team developed a detailed pro forma spreadsheet tool, attached as a separate Microsoft Excel workbook. While this tool provides detailed reporting on the estimated financial return of the envisioned hub model, it also allows for customizable applications testing different crop throughput, markets or cost structures. The pro forma user guide contained as the third appendix to this report gives a walkthrough on how to use the pro forma tool in customized applications.

The project team's detailed financial analysis of a food hub serving Delta agriculture finds the project business model and infrastructure investment to be financially feasible. Given the business model assumptions laid out in the above, the project team estimates the investment would produce a positive net cash flow by the sixth year of operation, and achieves a positive Internal Rate of Return (IRR) by year nine.

Like many business start-up activities, the team's financial estimates suggest the facility would operate at a net loss during its initial years, as volumes are low and the operator incurs equipment and other capital costs. The facility's cost structure shifts to a positive cash flow as the study's phasing analysis expands from start-up to full capacity. While the financial analysis suggests the facility to be financially viable over the course of this plan, it is important to note the need for the operator to cover operating expenses through the start-up phase, and the risk involved in the business enterprise.

At full capacity the Delta-serving food hub would generate revenue of over $16 million a year. As debt service on capital costs are paid down, this translates into a net positive cash flow of over $2.3 million a year to the hub operator, underscoring the economic potential in the facility. Notably, the food hub facility specified for this project provides a higher economic return than other facility cost analyses performed by the project team in other agricultural systems due to the unique crop mix supply of local agriculture that builds off market opportunities. As explained above, the facility has the potential to generate additional revenue as it expands its suite of services and targets markets beyond wholesale.

In addition to testing the financial feasibility of the Delta food hub model developed in this project, the pro forma tool can also be used to test alternative assumptions about crop supply, business scaling or capital investments. For example, the above business model assumes the construction of a new facility to house the hub activities. Alternative investment models may pursue retrofitting and refurbishing an existing facility in lieu of new construction, if a promising location is identified. Preliminary testing of a food hub business model using a refurbished facility show the effect of capital costs on overall return—under simplified retrofit assumptions, this alternative model has a positive net cash flow by year five and a positive return on investment (Internal Rate of Return) by year eight, a year sooner as compared to the original pro forma model. However, a full retrofitting analysis would need to update these simplified cost assumptions with the design elements of an actual facility.

Across applications of the financial feasibility tool it is important to note the considerable challenges in siting new infrastructure and development investments in the study area. The financial analysis of a phased facility suggests the food hub could easily provide an important supply for local Bay Area and Sacramento fresh food demand while providing a positive return on investment for the hub operator. Yet work conducted in the study's market scan and existing conditions research illustrates how any new developments within the Delta or expansions of existing facilities are constrained by increasing mandates and regulations that are costly and time consuming. Under current conditions, Delta growers (aside from small vineyards and wineries) interested in value-added handling and processing of their crop production must look to areas outside the Delta for aggregation facilities. A food hub investor and operator would need to consider these constraints in tandem with the estimated financial return of the food hub business model as well as where expanded infrastructure investments could feasibly locate, which may mean the value-adding component of the hub would be captured on the periphery or outside the study area.

Photo Credit: Delta Protection Commission

Table 11. Delta Food Hub- Financial Feasibility Toolkit
10 Year Annual Operations – Project Life

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue		**$500,500**	**$825,000**	**$1,200,000**	**$4,053,130**	**$8,991,089**	**$11,145,108**	**$16,234,065**	**$16,234,065**	**$16,234,065**	**$16,234,065**
Processing Lines		$500,500	$825,000	$1,200,000	$4,053,130	$8,991,089	$11,145,108	$16,234,065	$16,234,065	$16,234,065	$16,234,065
Add'l Services Revenue											
Expenditures		**$746,868**	**$1,090,950**	**$1,468,337**	**$4,525,479**	**$8,847,463**	**$10,076,804**	**$13,870,394**	**$13,870,394**	**$13,870,394**	**$13,870,394**
COGS (w/pkging)		$423,926	$712,448	$1,036,288	$2,890,908	$6,087,914	$6,898,591	$9,733,142	$9,733,142	$9,733,142	$9,733,142
Labor		$270,952	$324,643	$368,368	$1,024,167	$1,534,788	$1,699,605	$2,097,656	$2,097,656	$2,097,656	$2,097,656
Operating Costs		$51,989	$53,859	$63,681	$610,405	$1,224,761	$1,478,608	$2,039,596	$2,039,596	$2,039,596	$2,039,596
Net Op. Inc. (EBITDA)		**($246,368)**	**($265,950)**	**($268,337)**	**($472,349)**	**$143,625**	**$1,068,304**	**$2,363,672**	**$2,363,672**	**$2,363,672**	**$2,363,672**
Percent of Sales		-49%	-32%	-22%	-12%	2%	10%	15%	15%	15%	15%
Debt Serv. on Capital Costs			**($103,578)**	**($484,660)**	**($541,354)**	**($601,457)**	**($698,523)**	**($744,935)**	**($744,466)**	**($744,466)**	**($744,466)**
Annual Equity Investments	**($373,434)**	**($265,950)**	**($710,908)**	**($664,297)**	**($105,140)**	**($105,531)**	**($169,796)**	**($82,369)**	**$0**	**$0**	**$0**
Net Cash Flow	**($373,434)**	**($512,318)**	**($1,080,437)**	**($1,417,294)**	**($1,118,843)**	**($563,362)**	**$199,985**	**$1,536,367**	**$1,619,206**	**$1,619,206**	**$1,619,206**
Internal Rate of Return								**-24%**	**-9%**	**0%**	**5%**
Operating Characteristics											
Total Tons Processed		300	550	800	2,577	5,154	5,930	7,804	7,804	7,804	7,804
Revenue per lbs		$0.74	$0.75	$0.75	$0.79	$0.86	$0.94	$1.04	$1.04	$1.04	$1.04
COGS per lbs		$0.61	$0.50	$0.50	$0.56	$0.58	$0.58	$0.62	$0.62	$0.62	$0.62
Gross Margin		$0.12	$0.25	$0.25	$0.23	$0.28	$0.36	$0.42	$0.42	$0.42	$0.42
Percent of Sales		14%	33%	33%	29%	32%	38%	40%	40%	40%	40%

Total Cash Investment	$4,502,325
Operating Capital	$3,290,316
Capital Investments	$1,212,009

Source: SACOG and The Hatamiya Group, 2016

FARMER FEASIBILITY

The above financial feasibility analysis views performance through the lens of a hub operator and investor. While the analysis shows the Delta food hub business model to be financially feasible for a hub operator, it does not delve into the financial feasibility of local farmers supplying to the hub. To address this gap, the project team performed a feasibility analysis for Delta farmers using the shipping point prices in the food hub business model, in turn providing a fuller look at a food hub investment as a strategy to support broad-based local food system economic development.

To measure farmer feasibility we translate the potential crop throughput of the Delta food hub model into local acres of agricultural supply. Using our cost and return model, we investigate if Delta farmers in aggregate would be profitable selling to the potential hub at the prices established in the pro forma. This report's first technical appendix describes the cost and return model, including some of its limitations and assumptions.[24] Notably, while the food hub analysis selected target crops currently grown or with the potential to be grown in the study area, few are currently grown on a large scale in the Delta. In particular, the envisioned food hub model expands its throughput of leafy greens and brassicas through time.

In the farmer feasibility analysis we focus on three time periods—the hub's initial establishment, a stable operation at year four, and full capacity at year seven—to show how acres of supply change as the hub continues to expand. Table 12 reports hub characteristics and supporting agricultural acreage at these three phases of the facility. Overall, the Delta food hub business model requires very modest cropping pattern shifts in the study area. Indeed, in the first year of operation the hub would need Delta farmers to devote only 27 acres of supporting agriculture production. At full capacity this number rises to around 720 acres, still a gradual shift given the scope of agriculture in the study region.

Based on the RUCS cost and return model, Delta growers supplying to the food hub in its first year of operation would receive around $320,000 from the hub operator for their varied fresh fruit and vegetable crops (based on the farmgate prices collected through AMS), while incurring costs of $227,000 for this production (as quantified by the RUCS cost model). The analysis suggests that as the food hub expands throughput and increases its need for fresh local crop production, it is still able to offer pricing above the costs of production for local growers: at year four, local growers in aggregate would realize an estimated $800,000 net revenue from supplying to the hub compared to the estimated $75,000 earned today on the same acreage.[25] While this analysis predicts grower profitability in aggregate, some farmers may not be willing to take the prices offered by the hub business model, depending on individual production methods and other market opportunities.

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[24] In this analysis we grouped certain crops for integration into the model. One of the current limitations of this model is that relevant cost and return data is presently unavailable for a few crops grown in the Sacramento region; however, certain crops can be reclassified and data for significantly similar crop types is utilized as a proxy. For instance, red leaf lettuce and green leaf lettuce were combined into 'Lettuce – Leaf'; iceberg lettuce and romaine lettuce were combined into 'Lettuce – Iceberg'; spinach and kale were combined into 'Small Farm Leafy Greens'; and carrots were reclassified as 'Small Farm Root Vegetables.' In addition, SACOG generated input and output data for each of the "Small Farm-" blends in our model (including Small Farm Leafy Greens and Small Farm Root Vegetables, referenced above), as well as input and output data for fresh strawberries, tailored to the environmental constraints of the Sacramento region.

[25] As explained in the following scenarios section, the food hub target crop blend replaces a mix of existing crops, led by alfalfa, wheat, corn sunflower and beans. Year seven of the food hub is modeled in this scenario section.

Table 12. Needed Agricultural Acres to Support Delta Food Hub Facility

Estimated levels of Delta agriculture acreage to support a food hub operation, by year of hub operation			
Hub Characteristics	**Year 1**	**Year 4**	**Year 7**
Processing lines	2 limited	2	4
Tons of production/hr.	<1	1	4
Total tons (yearly)	300	2,577	7,804
Phase of Hub	Incubation	Stabilization	Full Capacity
Agriculture Acreage Needed	27	221	719

Source: Project Team Analysis

The farmer feasibility analysis is an important element to the study in that it illustrates that even if a food hub where located outside of the study area, the investment could still support economic growth for Delta farmers—the cost and return model suggests that growing fresh fruits and vegetables in the Delta to supply a local food hub would be a profitable cropping pattern for local farmers in aggregate. This finding complements the financial feasibility analysis for the food hub operator, as together the analyses predict the price structure articulated in the Delta food hub business model to provide a positive return to both hub operator and hub supplier. Yet while a locally serving food hub seems to be viable, this investment represents just one possible strategy to leverage agriculture as economic development in the Delta. The final section of the report compares a series of possible strategies—including a food hub scenario—to stimulate agricultural-based economic development that aligns with the Delta's unique and interconnected ecosystem while building off the study's local food assessment.

VI. ENVISIONING THE FUTURE: DELTA AGRICULTURE SCENARIOS

Using the context of existing agricultural conditions in the Sacramento and Yolo county portions of the legal Delta, this case study imagines a range of agricultural scenarios, detailing a magnitude of economic, environmental, and social impacts of potential cropping patterns that build off the study's local food assessment. The hypothetical cropping mixes are applied to 129,000 cropland acres designated as Agriculture in the general plans for the Yolo and Sacramento County communities within the Delta (excluding rangeland acreage). The scenarios are compared on metrics such as gross and net revenue, return on investment, labor requirements, and water demand.[26] They evaluate potential changes in comparison to existing cropping patterns – the base case – as well as to each other.

While these scenarios are theoretical, they offer insight into how changing cropping systems may present a range of outcomes across various economic and environmental indicators. Furthermore, the scenarios described below are not prescriptive and represent a small subset of possible scenarios for agriculture in the North Delta. Rather, these scenarios use data to define a spectrum of outcomes that could be expected from a variety of crop mixes, across changing market conditions. Scenarios of particular interest to regional stakeholders will require more detailed investigation before pursuing policies and investments to implement those plans. The information produced by these scenarios is intended to help decision makers—growers, landowners, and policymakers—understand opportunities and challenges from changes in cropping patterns.

Methodology

The scenarios for this case study were generated using the base condition data from SACOG's 2012 Crop Map in combination with an agricultural economic viability tool that SACOG developed based on agricultural cost and return studies published by the University of California Cooperative Extension.[27] Previous case studies conducted by SACOG have often centered scenario analysis on exploring "boundary conditions" by designing extreme crop mixes to maximize or minimize one agricultural system metric, such as maximizing gross returns or minimizing water demand. These types of scenarios have provided extremely valuable insight to the system-wide economic, environmental, and social impacts of different crop mixes and illustrate the trade-offs of various stakeholder priorities across the region. However, for this case study, the scenarios are more practically specified using a methodology for converting acreage that considers market and environmental constraints within the area and realistic soil quality for each crop. Information on crop-specific agronomic factors and conditions advantageous

[26] When calculating irrigated water demand for crops, UCCE studies assume that soil stored water from rainfall will supply a portion of a crop's total water requirements. This water source is particularly key in augmenting early season water needs for perennial crops, which more efficiently utilize these stores than annual crops. Therefore irregular amounts of annual precipitation or irregular soil moisture levels can impact the amount of applied water needed to meet a crop's total water demand.

[27] University of California Cooperative Extension. Cost and Return Studies Series. Department of Agriculture and Resource Economics, UC Davis. Archived historical studies available from 1930s to present. Model for this study uses cost reports published through mid-2014. Available online at: http://coststudies.ucdavis.edu/en/current/.

to cultivation informed the allocation, including FMMP prime farmland classification,[28] soil suitability, soil pH, soil texture (giving preference for loamy soils, etc.), organic matter content,[29] RUCS' soil tier (generated for this analysis),[30] and cultivation history.[31] This approach produces scenarios that demonstrate feasible cropping pattern shifts and outcomes within the near-term. All scenarios operate on a seven year time frame to compare possible alternatives in the time it would take a food hub investment to reach peak capacity.

Several "dials" were installed in the analysis tool that can adjust factors such as operating, overhead, and establishment costs; land costs; water and irrigation costs; labor costs; chemical and fuel costs; and production yield. These dials allow for analyses to show the variance in costs and returns when, for example, there is outright land ownership versus ongoing land costs, orchards or vineyards are at maturity versus first established, there is readily available water versus supply shortages, and to reflect price variability in inputs used in growing crops. The case study's first appendix documents the model assumptions. All the scenarios share the same assumptions and dial levels.

The model multiplies per-acre quantity and cost data for production inputs by acreage of a given crop in a scenario and then sums to create county-level scenario indicators of demand for production inputs. Yield and price data were used to determine revenue from production and, when compared to cost, provide net revenue and return on investment. The model provides a comparison of the inputs, outputs, and across scenarios to illustrate the outcomes resulting in crop shifts− if the 8,633 acres currently in red wine grape production increases to 10,000 acres, for example. These results reveal general cause and effect conditions that may be helpful in building strategies that capitalize on potential agricultural economic development.

Drawing on the project's local food market and facility cost analyses, the case study developed three scenarios—one continuing recent trends, another investing in a food hub, and a third fostering increased agritourism—that compare local food market opportunities for Delta farmers to existing base case conditions. In addition to demonstrating strategies that leverage the project's local food system assessment, the scenarios also are meant to align with the vision for Delta as articulated in the Delta Protection Commission's strategic plan. The following analysis describes the three scenarios in turn.

[28] 2012 Farmland Mapping and Monitoring Program data from the CA Department of Conservation (or 'FMMP' data), rates agricultural land parcels according to soil quality and irrigation status. This data was accessed in September 2015 from ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/2012/.

[29] Soil attributes used in this analysis were accessed from USDA's Web Soil Survey:
Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed 23 September 2015.

[30] The research team generated a 'Soil Tier' system, based on soil use descriptions from the USDA-NRCS Soil Survey Division's Official Soil Series Descriptions: https://soilseries.sc.egov.usda.gov/osdname.asp (Accessed January 2015) and USDA Soil Conservation Service "Soil Survey of Sacramento County, California." Issued 1993. Accessed January 2016 from: http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA067/0/sacramento.pdf.

[31] Distance from food hub crops was determined by creating a multi-ring buffer around existing food hub crops in the base case scenario. Cultivation history data includes 2008 and 2012 records for each parcel, stored within SACOG's 2012 crop map layer.

Case Study Scenario Results

TREND SCENARIO

The "Trend Scenario" models the outcomes associated with a continuation of recent trends in cropping patterns within the study area. Acreage changes have been scaled to maintain the current trend line, modeling the increase in crop acreage if study area producers were to continue recent cropland changes for an additional seven years. These trends were identified by analyzing shifts in the Yolo and Sacramento County Crop Reports from 2008 through 2014 and then refined by comparing the countywide trends with shifts in the 2008 and 2012 SACOG field crop map for the specific study area.

Based on these trends in cropping pattern shifts, this scenario adds an additional 800 acres of wine grapes, 125 acres of olives produced for oil, and 150 acres of fresh market vegetables. The added vegetable acreage was comprised of a proportional blend of the vegetable acres reflected in the base case scenario.[32] With just a slight increase in cost (less than 1 percent) and labor (2 percent), the gross returns from the Trend Scenario crop mix are almost $6 million higher than the base case cropping patterns in the same year, showing the steady momentum in the area's agricultural sector.

Table 13. Trend Scenario Model Data

Output Metric	Value	Crop	Acres
Total Costs	$249,853,268	**Grapes -** ***for Wine***	**800**
Gross Returns	$296,621,743	**Olives -** ***for Oil***	**125**
ROI	19%	**Fresh Market Vegetables**	**150**
Net Revenue	$46,769,375	Tomatoes - *Fresh Market*	*84*
		Asparagus	*27*
Operating Costs	$168,322,536	Small Farm Root Vegetables	*20*
Cash Overhead Costs	$41,148,052	Diversified Farm - Vegetables	*12*
Non-Cash Overhead Costs	$49,290,821	Squash	*4*
		Onions	*1*
H2O (acre inches)	3,324,331	Broccoli	*1*
Labor (hrs)	3,116,173	Melons	*1*
Yield (tons)	1,146,662	***Total Acres Converted***	***1,075***

[32] Due to the nature of the underpinning data sources (i.e. Pesticide Use Report data, remote sensing, etc.), SACOG's crop map generally classifies commodities simply by their crop type, rather than their intended use (acres producing 'Apples' are classified as such, rather than specifying 'Fresh Market Apples' or 'Processing Apples'; acreage of olives produced for oil is bundled with 'table' olives). For commodities where differentiated Cost & Return data is available for each processing type, on-the-ground acreage is divided among each use within SACOG's cost and return model. Tomatoes grown for fresh market consumption are bundled with processing tomatoes; the model estimates that 'Tomato – Fresh Market' represents 14% of 'Tomato – Processing' total acreage. This percentage of the base scenario's 'Tomato – Processing' acreage was used in determining the proportional blend of fresh tomato acres to be added in this scenario.

FOOD HUB SCENARIO

Building upon the local market opportunity of a food hub facility in the Sacramento-Yolo Delta, the "Food Hub Scenario" analyzes the on-field economics of a crop mix of fruits and vegetables demanded by the specified food hub at peak operation and evaluates the relative costs and returns associated with establishing a new food hub operation within the study region. In contrast to the above Trend Scenario, the food hub analysis is meant to represent a more proactive approach to foster economic growth through the local agricultural system. While Section V, Strategies to Support the Local Delta Food System: Food Hub describes the profitability of a food hub from the facility operator's perspective, this scenario provides perspective as to whether the cropping patterns necessary to fully supply a regional food hub operation would be advantageous to the Delta growers supplying a hub with its fresh produce as well. As mentioned above, a phased approach over seven years would allow for a reasonable entry point into the Delta food system. Cropping changes for this scenario reflect the regional production acreage needed to supply produce inputs a single food hub at its seventh year of operation (i.e at full capacity).

Table 14. Food Hub Production Acreage Scenario Calculation

FOOD HUB INPUT CROP	*Existing Base Case Crop Ac.*	Crop Acres to Serve Hub[33]	New Acres Needed
Apples - Fresh Market	*255*	40	*0*
Blueberry	*31*	12	*0*
Broccoli	*17*	247	**230**
Celery	--	8	**8**
Lettuce - Iceberg	--	9	**9**
Lettuce - Leaf	--	17	**17**
Onions	*20*	8	*0*
Peaches - Fresh Market	*54*	10	*0*
Pears - Green Bartlett	*6,263*	3	*0*
Peppers - Fresh	--	30	**30**
Potatoes - Fresh	--	44	**44**
Raspberries	--	9	**9**
Small Farm Leafy Greens	--	82	**82**
Small Farm Root Veg.	*330*	67	*0*
Strawberry - Fresh	*29*	83	**54**
Sweet Potato	--	19	**19**
Tomatoes - Fresh Market	*1,451*	32	*0*

[33] See Appendix 4 for full table of calculation of production acreage required for Year 7 food Hub Model.

The Food Hub Scenario includes crops currently being produced at scale in the Sacramento-Yolo Delta, as well as crops not widely produced in the Sacramento-Yolo Delta currently, but that are suitable for local distribution and consumption based on market opportunities in both greater Sacramento and the Bay Area. As shown in Table 14, some of these crops are currently widespread in the study area, some are grown at smaller scales, and others not currently grown, though should be viable given climate, soil and water characteristics. While the cost and return data for several of the proposed crops is based on production practices in regions throughout California and may differ from local production practices and costs reflected in the study data, the scenario generally illustrates that Delta growers would yield a positive return by supplying specialty crops for the food hub and thereby increase the amount of fresh and locally-produced specialty crop fruits and vegetables in the local food system.

The scenario models this mix of fresh market vegetables with the potential to be processed by the proposed food hub, dedicating 200 existing acres of production and shifting 500 additional acres from the base case into food hub crops to meet the required throughput of the food hub business model. The additional increase in agricultural value estimated from the Food Hub Scenario is slightly greater than the trend scenario, but with less costs, resulting in the highest net revenue and return on investment for Delta farmers of any of the modeled scenarios. Looking at per acre model outputs for the farms serving the food hub calls attention to the economic potential of the scenario: the 700 acres supplying to the food hub provide more than double the return on investment (by percentage) compared to the base case. Importantly, these estimates include the value of food grown in the Delta when it leaves the farm, but not the further economic contribution of processing, distribution and other value-adding activities performed by the hub facility, which may or may not take place in the study region.

In addition to an increase in the economic value of food grown in the region, the Food Hub Scenario also predicts an increase in farm labor demand of about 3 percent compared to the base case. Thus this cropping pattern shift could lead to more farm job opportunities in the Delta, yet it is also important to recognize the challenge of finding workers in agriculture's constrained labor supply. When looking at water use, the Food Hub Scenario does require slightly higher water availability in the agricultural sector, although the additional 183 acre feet per year is a fraction of a single percent point increase.

Table 15. Food Hub Model Data

Output Metric	Value	Crop	Acres
Total Costs	$249,758,783	**Fresh Market Vegetables**	
Gross Returns	$297,020,798	Broccoli	230
ROI	19%	Celery	8
Net Revenue	$47,262,014	Lettuce - Iceberg	9
		Lettuce - Leaf	17
Operating Costs	$169,479,847	Peppers - Fresh	30
Cash Overhead Costs	$40,952,850	Potatoes - Fresh	44
Non-Cash Overhead Costs	$48,140,827	Raspberries	9
		Small Farm Leafy Greens	82
H2O (acre inches)	3,331,123	Strawberry - Fresh	54
Labor (hrs)	3,131,398	Sweet Potato	19
Yield (tons)	1,151,667	***Total Acres Converted***	***503***

AGRITOURISM SCENARIO

Like the Food Hub Scenario, the "Agritourism Scenario" aims to model a further proactive strategy that leverages local food opportunities to grow Delta agriculture and jobs. The scenario operates on the same seven year timeframe as the study's other two modeled scenarios. As with the hub scenario, the results capture the economic value of the food grown in the region, but not the further economic activity as the food leaves the farm and circulates through the local community as the full impact of these activities are still unclear. SACOG's forthcoming multiplier model can help quantify the effects of such off-farm economic activity.

The Agritourism Scenario explores a potential cropping pattern that incorporates crop types with the greatest potential for capitalizing on agritourism opportunities within farm operations in the study area. Several types of crops currently grown in the Delta are identified as having the potential to support agritourism in different forms, including artisanal processing crops, such as wine grapes and olives for oil; "U-Pick" crops, such as pears, cherries, apples, peaches, figs, blueberries, and strawberries; and vegetable crops. Increased 'tourism' on farms can offer potential for agriculturalists to earn higher returns on their products by selling fresh produce, such as fresh fruits and vegetables, or value-added processed goods, such as olive oil, directly to consumers through on-site farm stands or small shops. Agricultural producers can also explore other agritourism-related revenue streams, by launching a bed and breakfast or rural restaurant; establishing a winery, brewery or olive mill; renting outdoor space or facilities for special events, such as weddings; establishing a 'U-pick' component to their farm, wherein visitors can go out into a field and pick their own fresh produce or farm products, ranging from apples and berries to pumpkins and Christmas trees. Additionally, as consumers become more conscious of food choices and agricultural production, farms have increasingly introduced opportunities for consumers to tour their farm, visit for a farm dinner, or stay on a farm for one or more nights, to give a chance for visitors to connect with where their food is coming from and learn more about the production process.

Proximity to other agritourism operations is advantageous to the success of new agritourism attractions. Clusters of similar business can reap the benefits of economies of agglomeration. In many cases, rather than suffering from competition with a neighboring enterprise, similar businesses can benefit from their proximity by becoming a destination for customers seeking a given product, resulting in more consumer traffic than an individual business may have drawn in isolation.[34] Rural by nature, agritourism enterprises tend to be located further away from large concentrations of consumer demand and are therefore less

> El Dorado County's Apple Hill is a tremendously successful regional example of agritourism clustering, attracting customers from throughout Northern California for high quality local produce and a fun recreational experience, while enabling producers to sell fresh produce and value-added artisanal processed products, such as pies, cider, and jams, directly to consumers. The high volume of customer traffic associated with this agritourism destination provides additional opportunities for other business ventures, such as restaurants, bed & breakfasts, and breweries, as well as opportunities for alternative revenue sources, such as offering tractor rides, or selling non-agricultural products like handmade jewelry and souvenirs.

Apple Hill Growers Association (2015): http://www.applehill.com/.

[34] Kuah, Adrian T. H. "Cluster Theory and Practice: Advantages for the Small Business Locating in a Vibrant Cluster" *Cluster Theory and the Small Business.* Journal of Research in Marketing and Entrepreneurship: Volume Four, Issue 3, 2002. (206-228). Accessed 3 May 2016 from: http://web.ewu.edu/groups/cbpacea/2002FallArticles/clustertheoryandpractice-advantagesforthesmallbusinesslocatinginavibrantcluster.pdf.

likely to gain a significant portion of income from incidental customers who were simply passing by, for instance, as a shop in an urban area might benefit from foot traffic. For this reason, the benefits of increased customer traffic associated with clustering can be hugely instrumental to the success of agritourism operations in particular, as customers do not need to necessarily make a deliberate choice to visit a particular winery, for instance, decreasing the burden of an individual operation to market themselves.

In successful examples of such agglomeration, the increase in overall sales that result from increased consumer traffic outweigh the value of sales lost to neighboring competitors for an individual business. For an industry like agritourism this effect is expected to be even more pronounced, as customers seek out not only products, but a broader recreational experience that may presuppose visiting, for example, multiple wineries in a single outing. As such, the negative impacts of competition may be reduced, as patrons may expect to spend money at multiple establishments, rather than selecting one individual vendor. As previously described in Section IV: Barriers to Growing for the Local Market, the burgeoning Clarksburg Wine Country appellation, a nearly 57,000 acre area of Delta farmland spanning through Sacramento, Yolo, and Solano counties,[35] is a great example of the benefits of clustering agritourism operations for mutual benefit. Several wineries and growers within the appellation have joined together to form groups, such as the Clarksburg Wine Growers and Vitners Association, to promote the region's wine and the member winemakers.[36] The Old Sugar Mill, hosting eleven wineries from the association, has become a successful tourist draw– hosting tours, public and private events, and weddings.

In building the Agritourism Scenario the project team performed a suitability analysis to help identify opportunity sites for conversion to agritourism crops, based on various factors advantageous to the establishment of agritourism operations within the study area, including proximity to existing agritourism sites (predominantly wineries), tourism-oriented crops, and roads and highways providing access to potential tourists. Yolo and Sacramento County's respective zoning codes were also used a resource for identifying areas with fewer regulatory constraints around agritourism activities, such as establishing farm stands, wineries, bed and breakfasts, rural restaurants, U-pick farms, or special event facilities. [37] The scenario includes the current agritourism crop acreage, plus a conversion of an additional 1,000 acres to crop types with agritourism potential in the identified areas most suitable for potential agritourism activities. Based on shifts in cropping patterns towards agritourism-supporting crops, this scenario includes an additional 525 acres of artisanal processing crops (i.e., wine grapes, olive oil), 325 acres of U-Pick fruit crops, and 150 acres of fresh market vegetables.

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[35] Apellation America Inc. "Clarksburg (AVA) profile." Accessed 21 April 2016 from: http://wine.appellationamerica.com/wine-region/Clarksburg.html.

[36] Clarksburg Wine Growers and Vintners Association. "About the CWGVA." Accessed 15 January 2016 from: http://www.clarksburgwinecountry.com/about-the-cwgva/.

[37] Yolo County Planning, Public Works, and Community Services Department. Yolo County Zoning Code, Title 8: Land Development, Chapter 2: Zoning Regulations, Article 3: Agricultural Zones. Adopted July 2014, with amendments through October 2015. Accessed 15 February 2016 from http://www.yolocounty.org/community-services/planning-division/2014-zoning-code.

Sacramento County Zoning Code, Chapter 3: Use Regulations. Section 3.2: Tables of Allowed Uses & Section 3.4: Agricultural Use Standards. Effective 25 September 2015, Amended 09 March 2016. Accessed February 2016 from http://www.per.saccounty.net/LandUseRegulationDocuments/Documents/Zoning%20Code%20Final%20Adopted%20July%2022%202015/Updates%20to%202015%20Zoning%20Code/ZC%20COMPLETE%20-%20Effective%20September%2025%202015%20Amended%2003-09-16.pdf.

The Agritourism Scenario provides the greatest gross returns of any of the modeled scenarios, at about $9.5 million above the base case (and around $3.5 million above the other two scenarios). It also results in the greatest increase in farm labor demand, nearly 8 percent above existing levels. As such, the scenario demonstrates potential future Delta job opportunities stemming from the agricultural system. Like the Food Hub Scenario, these estimates include the on-farm labor demand, not the additional economic activity associated with the scenario but occur off the farm. Finally, the scenario has the highest overall water use of the three, but the increase of approximately 200 acre feet per year above the levels estimated in the base case represent less than one tenth of one percent of the total water used by agriculture in the study area.

Table 16. Agritourism Scenario Model Data

Output Metric	Value	Crop	Acres
Total Costs	**$252,969,541**	**Artisanal Processing Crops**	**525**
Gross Returns	$300,150,424	Grapes - *for Wine*	*500*
ROI	19%	Olives - *for Oil*	*25*
Net Revenue	$47,180,883	**Small Farm Vegetables**	**150**
		Diversified Farm - Vegetables	*50*
Operating Costs	$171,162,274	Small Farm Root Vegetable	*50*
Cash Overhead Costs	$41,200,549	Small Farm Leafy Greens	*50*
Non-Cash Overhead Costs	$49,559,385	**U-Pick Fruit Crops**	**325**
		Pears - Green Bartlett	*35*
H2O (acre inches)	3,331,321	Cherry	*35*
Labor (hrs)	3,294,952	Apples	*35*
Yield (tons)	1,148,719	Pears - Organic	*35*
		Peaches - Fresh Market	*35*
		Figs	*35*
		Blueberry	*35*
		Strawberry - Fresh	*35*
		Diversified Farm - Fruit Trees	*45*
		Total Acres Converted	***1,000***

SCENARIO COMPARISON

As demonstrated in the metrics used to evaluate the scenarios above, the profitability of the Delta agricultural industry can be measured several ways – gross returns measure the cash flow to growers, net revenue measures grower profitability, and ROI indicates the rate of return of an investment. Additionally, the other indicators denote key environmental (water) and business (labor and yield) considerations for farmers, stakeholders, and policy makers.

Table 17 shows how the three scenarios compare to existing conditions in the base case. The Trend Scenario uses the least amount of water, but also produces the lowest yield (both slightly less than the base case scenario). Even with less water use, the scenario generates higher economic returns compared to existing conditions, yet lags somewhat the returns of the more active policy scenarios. In contrast, the Agritourism Scenario requires the most labor—at more than 8 percent above the base case scenario—and produces the greatest gross return, thus demonstrating overall job opportunity and economic activity. While the Agritourism Scenario provides the highest gross returns (albeit with the highest total costs), the Food Hub scenario yields the highest net revenue and the highest ROI.

The economic potential of these scenarios becomes especially apparent when analyzed on a per acre basis of cropping pattern changes. Table 18 compares the per-acre average of the crops changed in each scenario to the per-acre average of the base case, thus isolating the economic impact of the constrained cropping changes in the scenarios.

Table 17. Scenario Summary

		Scenario Changes from Base Case		
	Base Case	Trend	Food Hub	Agritourism
Total Costs	$245,488,416	+$4,363,952	+$4,270,368	+$7,481,125
Gross Returns	$290,713,354	+$5,908,389	+$6,307,444	+$9,437,070
Net Revenue	$45,224,938	+$1,544,437	+$2,037,076	+$1,955,944
H2O (acre inches)	3,328,927	-4,595	+2,196	+2,392
Labor (hours)	3,042,659	+73,513	+88,739	+252,292
Yield (tons)	1,148,829	-2,167	+2,838	-110

Table 18. Per-Acre Average: Base Case Compared to Scenario New Cropping Patterns*

Per-Acre	Base Case	Trend	Food Hub	Agritourism
Total Costs	$1,625	$4,110	$4,819	$6,710
Gross Returns	$1,925	$5,564	$7,119	$8,464
ROI	18%	35%	48%	26%
Net Revenue	$299	$1,454	$2,299	$1,754
H2O (acre inches)	22	19	23	23
Labor (hours)	20	69	100	226

**The per-acre averages for each of the three scenarios only include the acres changed from the base case, not the entire cropping pattern.*

VII. CONCLUSION

The Local Food System Assessment for Yolo and Sacramento County Delta Communities is a project conducted by SACOG and The Hatamiya Group in partnership with the Delta Protection Commission. The case study deploys the modeling and analysis tools constructed as part of the Rural-Urban Connections Strategy to show the integral role agriculture plays in meeting the shared vision for a healthy, sustainable quality of life that recognizes the importance of the Delta to the region as well as to all Californians.

Looking forward, the work highlights the growing demand for local, source-identified food as a potential market driver for agriculture in the Delta. The project's market review finds the Delta competitively situated to capitalize on this demand, yet the lack of locally-serving agricultural infrastructure serves as an impediment to expansion.

To help answer questions on how to overcome existing barriers, the project envisions a variety of potential agricultural scenarios in the study area that build off the local food system market assessment to foster food system economic development and job opportunities in the Delta. Unlike other scenarios that illustrate longer term, threshold setting conditions, the scenarios conducted for this work draw on data specific to the Delta to represent potential near-term outcomes as Delta stakeholders continue to build out the local food system. The scenarios are constrained by market conditions and physical capacity in the study area. As such, they characterize near-term strategies to activate further economic activity in the local food system. Through time, each scenario has the potential to build out even further returns on larger scales.

As demonstrated in the project's Trend Scenario, cropping pattern shifts in the Delta already are responding to new market conditions. The scenario illustrates the steady increase in gross agricultural returns if the trends in cropping pattern changes witnessed in the study area the last several years continue in the years to come. However, the project's final two scenarios—the Food Hub and Ag Tourism—embody possible strategies for stakeholders to actively promote even further near term economic development in the food system.

First, the Food Hub Scenario draws on the substantial work conducted by the project team in developing a customized food hub business model to serve local Delta agricultural. The team's feasibility analysis finds this business model to be financially feasible for both hub operator and farmer. Notably, the Delta-serving hub model (including the unique crop mix supply of Delta agriculture that builds off of local opportunities) provides a higher economic return than other facility cost analyses performed by the project team in other agricultural systems. However, the team also notes the challenges in siting new infrastructure and development investments in the study area.

While changing less than half a percent of existing cropping patterns, the Food Hub Scenario adds over $6 million in additional value of food produced on Delta farms compared to existing conditions. The scenario results in the highest return on investment and net revenue for Delta farmers. Importantly, this increase in gross farmgate value does not capture the additional economic activity the hub performs through its aggregation, processing and distribution capacity. SACOG's forthcoming food system multiplier project can serve as a resource on the full economic impact of food system investments.

Similar to the Food Hub Scenario, the Agritourism Scenario models another type of proactive strategy to build on momentum in the local food system. And like the hub scenario, the scenario's outputs only include the value of food as it leaves Delta farms. The economic and labor returns of the Agritourism Scenario speak to the potential of a variety of strategies to stimulate food system economic development and job opportunities in the Delta, yet also lead to a small increase in water use.

In short, the scenarios represent feasible near-term possible outcomes in food system shifts that are constrained by market and environmental factors. All cropping pattern shifts in the scenarios are less than one percent of the study area. As the strategies embodied by these scenarios grow through time, so too does the potential for further market opportunities and economic returns. Likewise, the strategies modeled in the scenarios have the potential to capture more of the associated economic activity of the full food system, yet the difficulty in building new infrastructure in the study area may mean this activity occurs farther along the supply chain, not on the farm. Finally, the case study has focused primarily on the economic contribution of agricultural land. Yet as articulated in the Delta Protection Commission's strategic vision, this same agricultural system also serves an essential habitat for waterfowl using the Pacific Flyway (as well as other wildlife) and other ecosystem services, so that the continued preservation of agriculture in the Delta also meets open space, habitat and other environmental outcomes. SACOG looks forward to further engagement with the Delta Protection Commission, farmers, business owners and further private sector stakeholders to continue the analysis and planning contained in this study.

Photo Credit: USFWS Pacific Southwest Region, Creative Commons license

VIII. APPENDICES

Appendix 1. Cost and Return Model

The University of California Cooperative Extension (UCCE), in partnership with the Department of Agricultural and Resource Economics at UC Davis, annually publishes Cost and Return studies which provide a summary of average costs assumed by growers to establish and produce a given crop as well as the returns from their sales. These studies are the authoritative source for the economics of agriculture production in California and provide the basis of the agricultural scenario analysis tool used to estimate inputs and returns of current cropping patterns and potential cropping scenarios in this study. Researchers estimate input costs based on "practices considered typical for the crop and area."[38]

Example: UC Cooperative Extension Cost and Return Study Data

UC COOPERATIVE EXTENSION
TABLE 2. COSTS AND RETURNS PER ACRE TO PRODUCE PASTURE 40 AC
SACRAMENTO VALLEY-2015

	Quantity/ Acre	Unit	Price or Cost/Unit	Value or Cost/Acre	Your Cost
GROSS RETURNS					
Hay 40 Ac	2.5	Ton	185.00	463	
Graze 40 Ac	5	AUM	35.00	175	
TOTAL GROSS RETURNS				638	
OPERATING COSTS					
Fertilizer:				**68**	
Ammonium Sulfate	200.00	Lb	0.34	68	
Custom:				**191**	
Ground Application	1.00	Acre	10.50	11	
Hand Labor	2.20	Hour	13.60	30	
Swath/Rake/Bale/Roadside	2.50	Ton	48.00	120	
Broadcast Fertilizer	1.00	Acre	10.50	11	
Harrow	1.00	Acre	15.00	15	
Rotary Weeder	0.50	Acre	10.50	5	
Herbicide:				**7**	
Roundup UltraMax	1.00	Pint	4.31	5	
2,4-D	0.50	Pint	3.55	2	
Irrigation:				**73**	
Water Delivered	54.00	AcIn	1.36	73	
Interest on Operating Capital @ 5.75%				0	
TOTAL OPERATING COSTS/ACRE				339	
NET RETURNS ABOVE OPERATING COSTS				298	
CASH OVERHEAD COSTS					
Office Expense				20	
Liability Insurance 45Ac				16	
Land Lease 40 Ac				180	

[38] University of California Cooperative Extension, "Sample Costs to Establish an Orchard and Produce Almonds: San Joaquin Valley North, Flood Irrigation." http://coststudyfiles.ucdavis.edu/uploads/cs_public/8f/0c/8f0ce321-295f-409b-8d3e-267cb5fb163d/almondfloodvn2011.pdf

Agriculture Economic Analysis Model

Drawing on the UC Cooperative Extension Cost and Return studies as its principal input, the Sacramento Area Council of Government's (SACOG) Rural Urban Connections Strategy (RUCS) has developed a scenario analysis modeling tool to calculate overall estimated costs and returns, including changes in cropping patterns given changes in input cost or commodity prices. The data from these studies is input into the model as published without any alteration by RUCS staff. As described below, the model does generate a custom crop type for strawberries and small farm categories given the lack of a study that could reflect average conditions in the study area. The model is updated when new Cost and Return studies are published. The tool currently contains cost and return data for 79 different crop types. These cost and return data are broken down to line item quantities and prices, allowing detailed analysis of factors such as water consumption and labor demand.

The UC Cooperative Extension releases studies for different regions across California. While the Cost and Return studies from the University of California Cooperative Extension used in this model are the authoritative source for the economics of agricultural production in the state, they estimate input costs and production based on typical growing practices for the area, which may not fully align to production geared to the local market. As such, some of the available Cost and Return studies are based on production methods and environmental conditions not found in the Delta region. In addition, the Delta's unique geography compounds this issue somewhat, as many complementary sources (such as County Crop Reports) publish data at the county level, but not in enough detail to isolate yields and returns on agriculture specifically for the Delta study area.

Therefore, in a few instances, the model includes data from a slightly older study based on Sacramento-region conditions, rather than a newer study based in an area with very different physical attributes. For a selection of crops where no study with similar environmental conditions is available, the cost and return data was adjusted to reflect growing conditions and practices in the Sacramento region. This study contextualized local conditions through both quantitative and qualitative research, as well as building out crop types serving the local market. The crop types subject to adjustment are listed on the following page.

Example of Crop Data Entry

Corn - Field

Inputs	
Price per Pound	$210.00
Quantity per Acre	6
Fuel - Gas	3.41
Fuel - Diesel	3.17
Lbs per unit	2,000
H2O (acinches)	31
Labor (hrs)	11.64
Yield (tons)	6.00
Land costs	230
Establishment cost	0

Source Data	
Year	2015
Region	Sacramento Valley and Nort
Title	Sample Costs to Produce Fie
Source	UC Davis Coop Extension Co:
Updated	September 2015 by Lynnea C
Located	S:\RUCS\Crop Data\Cost of P

Table 2: Costs and Returns per Acre to PRODUCE

Gross Returns		Quantity /Acre	Unit	Price or Cost/Unit	Value or Cost/Acre
Corn		6	Ton	$210.00	1,260
TOTAL GROSS RETURNS					$1,260
Operating Costs					
Fertilizer	10-34-0	151	Lb	0.55	83
Fertilizer	Zinc Chelate 6%	2	Pint	0.91	2
Fertilizer	20-0-0 Aqua Ammonium	250	Lb N	0.58	145
Chemical	Sevin 5 Bait (Pellets)	2	lb	0.78	2
Chemical	Oberon 2SC	3.6	floz	4.78	17
Chemical	Roundup PowerMax	4	Pint	4.31	17
Chemical	Clarity	0.5	Pint	14.880	7

The Crop Types adjusted in the RUCS cost and return tool include:

- Small Farm – Leafy Greens
- Small Farm – Nightshades
- Small Farm – Nuts
- Small Farm – Nuts (Organic)
- Small Farm – Root Vegetables
- Small Farm – Root Vegetables (Organic)
- Strawberries

Parameters and Use

The scenario analysis tool uses per-acre quantity and cost data for production inputs such as water, labor, chemical, fuel, and irrigation, as well as operating costs, overhead costs, and establishment costs. These data are multiplied by acreage of a given crop in a scenario and summed to create county-level scenario indicators of demand for production inputs. Yield and price data are used to determine revenue from production and, when compared to cost, provide net revenue and return on investment.

Several "dials" were installed in the analysis tool. These dials adjust factors such as establishment costs, land costs, water costs, labor costs, and production yield. These dials allow for threshold analyses to show the variance in costs and returns when, for example, orchards are newly planted compared to fully mature. The model generates several key outputs, including dollars of gross output, return on investment (ROI), water use, and labor hours.

Crop Cost and Return Summary

SUMMARY OF PRODUCTION COSTS PER ACRE PER YEAR		17	18 #	20	21	22	23	24
		Total Costs/Acre	Total Gross Returns	H2O (acinches)	Labor (hrs)	Yield (tons)	Land Costs	Establishment Cost
1	Alfalfa	$975	$1,200	21.00	6.19	6.00	$190	$114
2	Alfalfa - Organic	$1,281	$1,820	42.00	2.54	6.00	$288	$173
3	Alfalfa - Flood	$1,973	$1,995	42.00	14.84	7.00	380.00	230.00
4	Alfalfa - Sub-Drip Irr.	$2,270	$2,475	54.50	16.13	9.00	380.00	226.00
5	Almond	$3,677	$4,070	40.00	23.29	1.10	$349	$279
6	Almond - Organic	$4,377	$4,480	44.00	36.96	0.80	$916	$439
7	Apples - Fresh Market	$18,938	$18,180	36.00	367.59	9.00	$4,579	$971
8	Apples - Processing	$5,091	$6,050	6.00	94.45	22.00	950.00	0.00
9	Apples - Processing /Organic	$4,691	$4,875	6.00	96.29	15.00	950.00	0.00
10	Asparagus	$6,721	$5,320	30.00	32.48	2.00	$369	$347
11	Beans - Common Dried	$1,109	$1,080	28.00	5.19	1.13	$173	$0
12	Beans - Black-Eyed & Lima	$1,346	$1,250	30.00	6.37	1.25	$250	$0
13	Beans - Chinese Long	$9,657	$9,900	38.00	611.20	6.60	$300	$0
14	Blueberry	$30,241	$30,000	36.00	2138.02	5.00	$461	$1,335

Assumptions

The cost and return studies utilized for the scenario model are based on a hypothetical profile of an "average farm" for a particular crop type, as defined by UC Cooperative Extension researchers. The model constructs average expenditure and revenue profiles of farms. On an individual farm, differences in production methods, operational scale, and a variety of other factors can vary from this "average" profile. As such, this model is meant to operate only at the scenario level, not on an individual farm level.

The market price of crops fluctuates on a yearly basis. Similarly, the cost of inputs including labor and water costs can change over time, especially related to the recent drought which has limited California's water supply. Furthermore different farms are at a variety of establishment levels, which can greatly affect economic return, particularly for crops such as orchards that require a longer maturation period before they produce returns. Changes in the cost or value of these variables can impact the precision of modeling results. However, for the sake of consistency within a crop's cost report, the tool uses the values specified in the crop's cost of production report. As detailed above, we have incorporated various dials into our model with the ability to adjust some of these variables, but these values are kept at their default values unless as specified in the below.

Scenario Analysis Cost and Return Outputs

SCENARIO ANALYSIS		Input	Cost & Return Analysis				
		Acres	Total Costs	Total Gross Returns	Total Net Revenue	Average ROI	Operating
	Totals:	141,384	$390,734,893	$391,996,210	$1,261,317	0%	$276,35
1	Alfalfa	32019.9	$30,412,637	$38,423,878	$8,011,241	26%	$16,37
2	Alfalfa - Organic		$0	$0	$0	--	$0
3	Alfalfa - Flood		$0	$0	$0	--	$0
4	Alfalfa - Sub-Drip Irr.		$0	$0	$0	--	$0
5	Almond		$0	$0	$0	--	$0
6	Almond - Organic		$0	$0	$0	--	$0
7	Apples - Fresh	209.3467	$3,781,470	$3,805,923	$24,453	1%	$1,971
8	Apples - Processing	181.0131	$891,855	$1,095,129	$203,275	23%	$622,
9	Apples - Processing /Organic		$0	$0	$0	--	$0
10	Asparagus	437.6523	$2,886,472	$2,328,310	-$558,162	-19%	$2,476
11	Beans - Common Dried	2143.897	$2,133,162	$2,315,408	$182,246	9%	$1,612
12	Beans - Black-Eyed & Lima		$0	$0	$0	--	$0
13	Beans - Chinese Long		$0	$0	$0	--	$0
14	Blueberry	30.9254	$891,631	$927,762	$36,131	4%	$804,

For the establishment cost dial, the model assumes that non-orchard crops are split between production acres on land still in repayment or rented, and those where loans have been paid off, with 80 percent allocated to the former and 20 percent to the latter. Given the unique maturation period and recent growth of orchards, orchard crops have their own custom establishment dial: 17 percent of crop production in newly established acres with minimal or no harvesting, a further third on land still amortizing establishment loans, and half on full production land. These assumptions stem from SACOG analysis of the 2012 USDA Census of Agriculture.[39]

For the gasoline dial on the scenarios the model uses a value of $3.76 per gallon for diesel fuel and $4.08 per gallon for gas fuel. These prices also stem from SACOG analysis, this time of the US Energy Information Administration's "California 2012 average annual price for Gasoline: All Grades" and "Diesel" dataset. [40] These prices were adjusted to more accurately reflect price trends for the Sacramento-Yolo area by comparing Sacramento and Yolo County fuel prices with California averages across various time periods, using "California Metro Areas Fuel Prices" data from California State Automobile Association.[41] Given that diesel fuel consumption described in this study is predominantly off-road usage, the majority of the diesel fuel consumed is likely to be dyed diesel (more specifically red diesel), dedicated to non-taxable uses such as many functions of agricultural production. The on-road retail Diesel price was adjusted accordingly to remove added taxation values levied by the State of California for each respective year, and apply the adjusted dyed diesel sales tax rate, according to historical diesel fuel tax rates data from the California State Board of Equalization.[42]

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[39] USDA. "Table 30. Land in Orchards: 2012 and 2007" and "Table 31. Fruits and Nuts: 2012 and 2007." *2012 Census of Agriculture- California State and County Data: Volume 1, Pt 5*. National Agricultural Statistics Service, USDA. Issued May 2014. pg 460-484. Accessed 21 September 2015. Available online at: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_County_Level/California/cav1.pdf

[40] US Energy Information Administration (EIA): Independent Statistics & Analysis. "Weekly Retail Gasoline and Diesel Prices (Area: California, Period: Annual)." *Petroleum and Other Liquids.* (Release 25 January 2016). Accessed 27 January 2016, https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_sca_a.htm.

[41] California State Automobile Association. California Metro Areas Fuel Prices. Prices updated 2/24/2016 at 3:45 PM. Accessed 24 February 2016 from http://fuelgaugereport.aaa.com/states/california/california-metro/.

[42] California State Board of Equalization. "Diesel Fuel (Except Dyed Diesel) Rates by Period," *Sales Tax Rates for Fuels.* State of California, 2015. Accessed 24 February 2016 from https://www.boe.ca.gov/sutax/strf.htm

Appendix 2. Natural Resources Research Methodology

The project's scenario analyses deploy the RUCS cost and return scenario planning tool described in the above appendix to test possible strategies that Delta stakeholders may explore for food system economic development. A key component of these scenarios are that they are constrained by market, natural resource and other factors in order to represent feasible near-term outcomes. The scenarios section of the report describes the market assumptions for each scenario. This technical appendix expands on that summary to include more detail on the natural resource research and data collection conducted as part of the study and used to constrain potential cropping patterns.

WATER CONDITIONS

Water is vital to every aspect of the Delta – from recreation and tourism to agriculture to the regional economy. Yet the California Delta is the focus of complex issues involving water supply, water quality, flood control requirements, and the environment. The agricultural landscape of the Delta as we know it today was influenced greatly by efforts to reclaim flood-prone land, which became widespread in California in the mid- to late-1800s. With an influx of Gold Rush miners to the Delta region, occupants began to dike, drain, and levee the Delta marshlands to meet increased demand for agricultural production through a process known as "land reclamation".[43] California passed a series of legislative actions throughout the 1860s to augment collective levee-building, flood protection, agricultural drainage, and rural irrigation, through the creation of "reclamation districts".[44] According to GIS data from the California Department of Water Resources (DWR) Delta Levees Program and the Office of Emergency Services, reclamation districts still span over 131,000 acres (62%) of the Sacramento and Yolo county portions of the legal Delta.[45]

With the advent of these statewide water capacity and supply projects, such as the Central Valley Project (CVP) and the State Water Project (SWP) which redistribute ample rainfall supply from the north to the substantial population demand in the south, stakeholders within the Delta grew concerned over the continued security of their local water rights.[46] This led to the creation of a series of organizations, including the Delta Water Agency, to represent and protect Delta water interests, while still maintaining the power of reclamation districts and other stakeholders within the domain.[47] However, large-scale water management projects have begun to alter the Delta environment, leading to reduced water quality, damaged ecosystems, and a less reliable water supply. Increased advocacy in the Delta led to the passage of the 1959 Delta Protection Act which established the boundaries of the legal Delta and

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[43] Lund, et al. "2. The Legacies of Delta History", *Envisioning Futures for the Sacramento San-Joaquin Delta*. Public Policy Institute of California (PPIC), 2007, pg 19. Accessed 16 January 2016. Accessed from: http://www.ppic.org/content/pubs/report/R_207JLR.pdf.

[44] Ibid.

[45] Dudas, Joel, DWR Delta Levees Program, & Office of Emergency Services. "Reclamation district boundaries within the state of California." DataBasin.org, Conservation Biology Institute, (24 November 2014). Accessed 19 January 2016, from http://databasin.org/datasets/8aee127380164046b32c2c85dee44d55.

[46] Wilson, C. M. "1850-1930: The Reclamation Era," *Local Water Governance in the Delta: A Report to the State Water Resources Control Board and the Delta Stewardship Council,* (Issued 25 September 2014): 6. Accessed 19 January 2016, from: http://www.swrcb.ca.gov/water_issues/programs/delta_watermaster/docs/governance_092514.pdf.

[47] Ibid.

required that the SWP, in coordination with the CVP, provide a secure water supply while maintaining water quality standards and protecting valuable ecosystems in the Delta.[48]

In short, water use in the study area is highly complex. It is also difficult to find reliable, recent water usage or availability data specific to the study area. To overcome data limitations in many instances, data collected at the point level is interpolated in the study to create new inferred data points that estimate conditions between data collection points. In particular, the study area lacks sufficient data collection points in the form of groundwater well monitoring sites to build out reliable assumptions about the groundwater availability conditions. Given these data limitations, the project team worked with several data sources to create rough estimates of water use in the local agricultural sector. The water data used to estimate water usage for irrigation in this study is based on a 2010 study on Water Use in California published by USGS' National Water Use Information Program.[49] The study provides county-level data on water usage, for both surface water and groundwater and by withdrawal category, and includes 2010 irrigation water consumption for each county. When coupled with the acreage of irrigated land, it is possible to estimate total water usage for the study area.

The 2012 Farmland Mapping and Monitoring Program data from the CA Department of Conservation was used to generate spatial data classifying irrigated and non-irrigated land.[50] FMMP data rates agricultural land parcels according to soil quality and irrigation status.[51] The description of each of these rating categories (e.g., prime farmland) specified in the metadata, allows the various categories to be aggregated into two groups, irrigated and non-irrigated.[52] This provided an estimate of the irrigated acreage in- and outside of the study area in each county, which was used to generate an estimate of irrigated water usage (mgal/day) in the study area in 2010. This analysis assumes that the water intensity of crops grown on irrigated land and of irrigation practices, and therefore applied irrigation water, are roughly even across each county, when examined at a scenario level.

The Sacramento and Yolo county portions of the legal Delta are contained entirely within the jurisdiction of the North Delta Water Agency (NDWA).[53] The NDWA negotiated a 1981 contract with DWR guaranteeing a year-round water supply for agriculture and other beneficial uses in the northern Delta, and to compensate farmers for loss of net income caused by diminished water supplies in drought

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[48] Lund, et al. "2. The Legacies of Delta History", *Envisioning Futures for the Sacramento San-Joaquin Delta*. Public Policy Institute of California (PPIC), (2007): 33-34. Accessed 16 January 2016, from: http://www.ppic.org/content/pubs/report/R_207JLR.pdf.

[49] Water Use in California, 2014, Brandt, Justin; Sneed, Michelle; Rogers, Laurel Lynn; Metzger, Loren F.; Diane Rewis; House, Sally USGS Data Website, doi:10.5066/F7KD1VXV.
Accessed at http://ca.water.usgs.gov/water_use/2010-california-water-use.html.

[50] FMMP 2012 county dataset. Accessed at ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/2012/

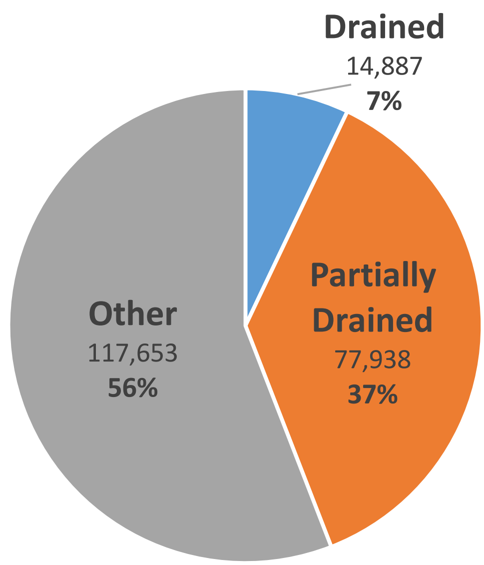
[51] California Department of Conservation, "Farmland Mapping and Monitoring Program." Accessed at http://www.conservation.ca.gov/dlrp/fmmp

[52] Yolo County ftp dataset. Accessed at ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/metadata/html/yolo_meta.htm#5

[53] Terry, M, et al. "Re: Scoping Comments of North Delta Water Agency Bay Delta Conservation Plan Environmental Impact Report/Environmental Impact Statement." North Delta Water Agency. Submitted 13 May 2009. Accessed 13 January 2016, from: http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/North_Delta_Water_Agency.sflb.ashx.

conditions.[54] Most of the land within the North Delta Water Agency's boundaries is used for agriculture.[55] According to 2012 data from the Farmland Mapping and Mitigation Program, the legal delta portion of Sacramento and Yolo Counties contains 135,840 acres that are likely irrigated, or have been irrigated in the past four years.[56] According to data from the Natural Resources Conservation Service, 44 percent of the acreage in the study area has been drained or partially drained (as shown in the figure below).[57]

Water Drainage in Case Study Area



Source: Natural Resources Conservation Service, 2014.

While Delta water use is primarily for agricultural purposes, there is also significant demand from residents in Delta communities and municipal operations. Groundwater is the primary supply source for the majority of residents and municipalities, as well as agricultural uses, which are located in the southern and western portions of the Delta. Like in the state as a whole, groundwater basins have been tapped for an increasing portion of water supply as California faced the fourth year of one of the most severe droughts on record. For surface water, diversions from several waterways converging in the Delta is the primary source of agricultural water use to the north. Further, some of the excess surface

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[54] Craig M. Wilson, Delta Watermaster. "1850-1930: The Reclamation Era," *Local Water Governance in the Delta: A Report to the State Water Resources Control Board and the Delta Stewardship Council,* (Issued 25 September 2014): 12. Accessed 19 January 2016, from: http://www.swrcb.ca.gov/water_issues/programs/delta_watermaster/docs/governance_092514.pdf.

[55] State Water Resources Control Board. "Revised: Water Right Decision 1641: Implementation of Water Quality Objectives for the San Francisco Bay/Sacramento San-Joaquin Delta Estuary." CA Environmental Protection Agency. Issued 29 December 1999, revised 15 March 2000, p. 64. Accessed 20 January 2016 from: http://www.waterboards.ca.gov/waterrights/board_decisions/adopted_orders/decisions/d1600_d1649/wrd1641_1999dec29.pdf.

[56] For explanation of analysis methodology, see http://www.conservation.ca.gov/dlrp/fmmp

[57] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed 23 September 2015.

water from the north is diverted from the Delta for agricultural, municipal, and residential use by the San Joaquin Valley, Santa Clara Valley, Tulare Basin, and Southern California.[58]

As mentioned above, overall there is very little reliable, recent water usage and availability data for the study area − many of the best available data resources for California lack information specific to the Sacramento-Yolo Delta. Analysis of 2010 county-level data published by the USGS suggests the study area used roughly 269 million gallons per day (mgal/day) of water for irrigation.[59] Likewise, the cost and return model developed for this study reports a similar level for water consumption and cost, estimating that the existing Delta crop mix utilized roughly 3,328,927 acre-inches per year (57,235 acre-feet/year or 247 mgal/day) in 2012.

Instead of constraining possible Delta agriculture scenarios by a limit on water availability, the study simply reports the estimated water use by scenario in comparison to the study's estimated base case usage, allowing the user to deem the feasibility of this projected use of a scare natural resource.

SOIL CONDITIONS

In contrast to the scarcity of consistent water data for the study region, soil conditions can be comprehensively mapped for the Delta. As such, the RUCS model does constrain market scenarios by soil quality in the area. In other words, the model does not allow cropping pattern shifts that do not conform to the soil quality data for the region. These data are described below.

The USDA Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS) tool is a national-scale data source covering 95 percent of the United States and represents the single authoritative source of soil quality data. Descriptions of every soil class are published by the USDA-NRCS Soil Survey Division in the Official Soil Series Descriptions database.[60] Overall, there are 41 soil types within the Sacramento-Yolo Delta study area.[61] The following table outlines the top 20 soil component types in the study area by acreage and provides an overview of the potential agricultural uses of each soil type. The two most prevalent soils, Sacramento and Gazwell clays, are present in about 34 percent of the study area and support production of orchards, row crops, rice, safflower, alfalfa, corn, and wheat.

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[58] California Department of Water Resources. June 2014. "Final CASGEM Basin Prioritization Results" and "CASGEM Groundwater Basin Prioritization Results- Unabridged Sorted by Overall Basin Score." http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm

[59] Estimate based on county-wide irrigation water usage proportionate to the acreage of irrigated land in the study area and the counties as a whole.
Water Use in California, 2014, Brandt, Justin; Sneed, Michelle; Rogers, Laurel Lynn; Metzger, Loren F.; Diane Rewis; House, Sally USGS Data Website, doi:10.5066/F7KD1VXV.
Accessed at: http://ca.water.usgs.gov/water_use/2010-california-water-use.html.

[60] Soil Survey Staff. Official Soil Series Descriptions: View by Name. USDA-NRCS Soil Survey Division, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Data from "current" survey, accessed July 2015. Available online at: https://soilseries.sc.egov.usda.gov/osdname.asp.

[61] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Data from "current" survey, accessed July 2015. Available online at: http://websoilsurvey.nrcs.usda.gov/.

NRCS Top 20 Soils by Acreage –Yolo and Sacramento County Legal Delta, 2015			
SOIL TYPE	**ACRES**	**TEXTURE**	**USE**
SACRAMENTO	24,767	Clay	Rice, safflower, row crops. Alfalfa & orchards if low water table
GAZWELL	24,010	Mucky clay	Corn & wheat
EGBERT	17,103	Silty clay loam	Irrigated cropland (sugar beets, tomatoes, safflower, alfalfa, barley, corn & sorghum milo)
CAPAY	14,188	Clay	Irrigated cropland (tomatoes, sugar beets, beans, grain, pasture), dry farm small grains, irrigated & dry pasture
RINDGE	11,920	Mucky silt loam	Asparagus, potatoes, tomatoes, corn, wheat, & barley
SYCAMORE	10,652	Silty clay loam	Orchard, row, and field crops, excluding rice
SCRIBNER	8,821	Clay loam	Irrigated cropland (tomatoes, corn, small grains)
DIERSSEN	8,791	Sandy clay loam	Irrigated pasture and irrigated cropland (corn, wheat, safflower, rice)
CLEAR LAKE	8,114	Clay	Row crops (tomatoes, beans and sugar beets), dry farmed to grain, irrigated or dry farmed pasture, rangeland
SAILBOAT	6,963	Silty loam	Irrigated orchards or cropland (corn, alfalfa, sugarbeets, wheat, asparagus, tomatoes, safflower, pears)
MERRITT	4,474	Silty clay loam	Irrigated, intensive cultivation (field & row crops)
SAN JOAQUIN	4,382	Loam	Cropland and livestock grazing (small grains, rice, vineyards, fruit and nut crops, irrigated pasture.)
VALPAC	4,324	Loam	Irrigated cropland (pears, grapes, wheat, corn, tomatoes) and irrigated pasture
OMNI	3,866	Silty clay	Irrigated row and field crops
WILLOWS	3,201	Clay	Rice, sugar beets, safflower
PESCADERO	3,184	Silty clay loam	Livestock grazing. Reclaimed areas used for irrigated field & row crops, pasture.
COSUMNES	3,182	Silty loam	Irrigated cropland (corn, wheat, tomatoes)
GALT	3,116	Clay	Range, dryland crops, irrigated pasture, rice, irrigated field crops
TYNDALL	3,064	Fine sandy loam	Intensive row, field, and orchard crops
LANG	2,802	Sandy loam	Irrigated orchards, row crops, forage crops, & field crops (corn, sugar beets, alfalfa, hay, walnuts, wheat)

The NRCS WSS also provides current soil survey data, classified by soil component for Sacramento and Yolo Counties, which ranks soil types and conditions by their broader limitations for growing irrigated field crops.[62] The table below lists the soil classes in this classification ranging from I to VIII, where the limitations of the soil are progressively greater as the numeric value of the class increases.[63] Within the Sacramento-Yolo Delta, 93 percent of the acreage within the study area has an assigned classification ranging from Class I to Class IV. As shown below, most of the Class IV soils are located west of the Sacramento River Deep Water Ship Channel and Prospect Slough in Yolo County, with significant Class II concentrations along riparian corridors in Sacramento County and Class I and II soils in western Yolo County near the City of Davis. The unclassified areas fall predominantly in areas comprised of or adjacent to water features.

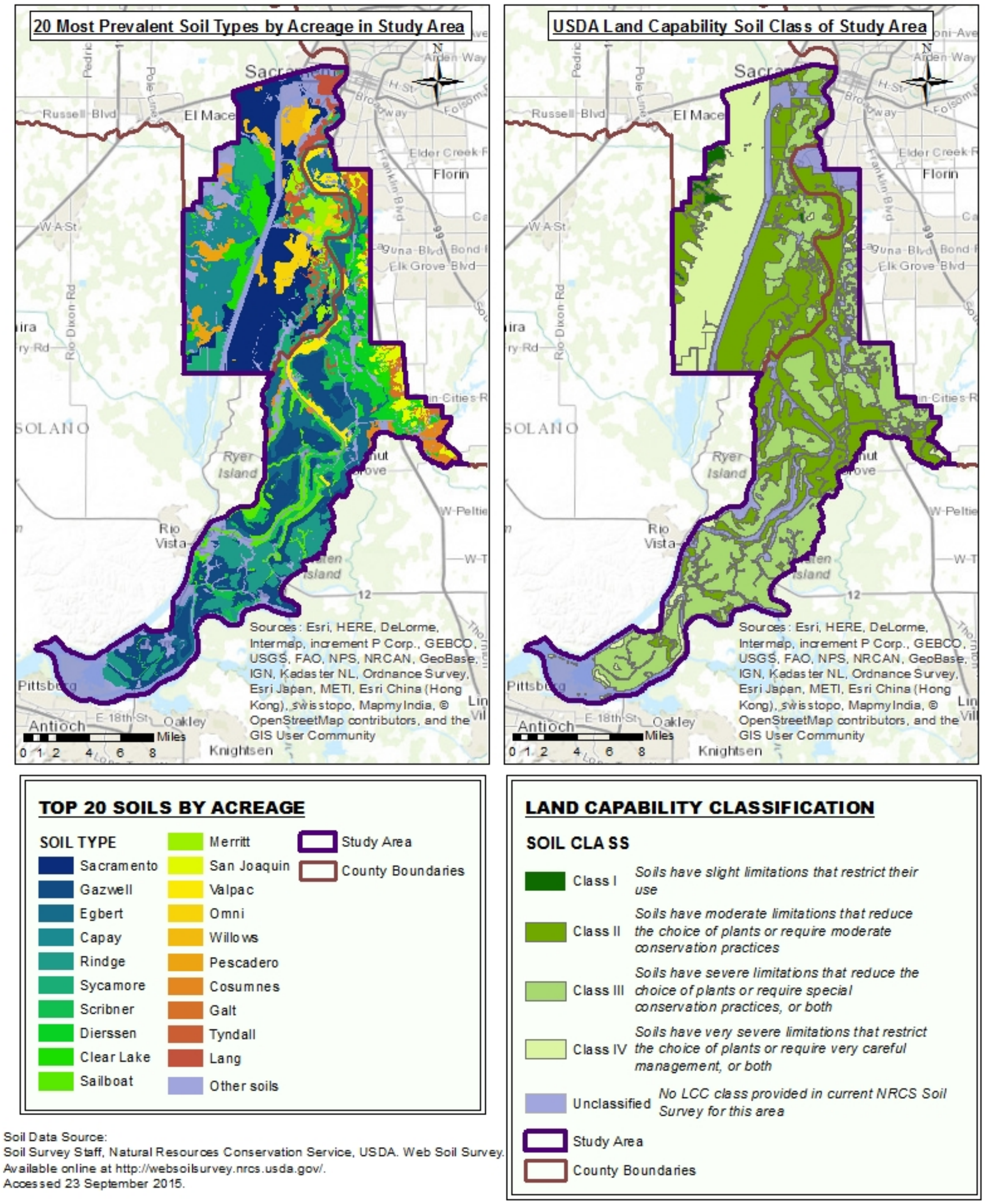
Together, these two data sets form the soil quality layer in the RUCS model. The layer has near-complete coverage of soils in the study area, and is used to document the feasibility of potential cropping pattern shifts and market opportunities given the constraints on soil use. The predominant attributes to determine allowable cropping shifts are (1) soil component, which describes the soil type according to the NRCS Official Soil Series Description (OSD), and (2) the NRCS Land Capability Classification System (LCC), which ranks soil types and conditions by their limitations for growing irrigated field crops.[64] The soil attribute data used in this study was downloaded without alteration, with the exception of soil Component. For the purposes of our study, we simplified the Component attribute field to represent just the name of the majority soil component for each record. For example, as shown in the figure below, the soil components listed under map unit symbol 177 were aggregated under the "Medisaprists" classification and the soil components listed under map unit symbol 200 were aggregated under the "Rindge" classification.

WSS Data Download Excerpt

Map unit symbol	Map unit name	Component name (percent)	Acres in AOI	% of AOI
177	Medisaprists, 0 to 2 percent slopes, frequently flooded	Medisaprists (90%)	1,458.10	1.50%
		Fluvaquents (5%)		
		Xeropsamments (5%)		
190	Pits	Pits (100%)	10.4	0.00%
200	Rindge muck, partially drained, 0 to 2 percent slopes	Rindge (95%)	2,141.70	2.20%
		Gazwell (3%)		
		Sailboat (2%)		

[62] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed 23 September 2015.
[63] University of Delaware, "Land Capability Classification." http://www.udel.edu/FREC/spatlab/oldpix/nrcssoilde/Descriptions/landcap.htm
[64] Ibid.

Soil Assessment of the Yolo and Sacramento County Portions of the Legal Delta



NRCS LCC Soil Class by Acreage – Yolo and Sacramento County Legal Delta			
SOIL CLASS	**CLASS DESCRIPTION**	**ACRES**	**% of STUDY AREA***
I	Soils have slight limitations that restrict their use	2,338	1%
II	Soils have moderate limitations that reduce the choice of plants or require moderate conservation practices	73,794	39%
III	Soils have severe limitations that reduce the choice of plants or require special conservation practices, or both	62,652	33%
IV	Soils have very severe limitations that restrict the choice of plants or require very careful management, or both	36,315	19%
V	Soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland and/or wildlife habitat	0	0%
VI	Soils have severe limitations that make them generally unsuited to cultivation and limit their use mainly to pasture, rangeland, forestland, or wildlife habitat	0	0%
VII	Soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland and/or wildlife habitat	0	0%
VIII	Soils have limitations that preclude their use for commercial plant production and restrict their use to recreation, wildlife habitat, or water supply or to esthetic purposes	0	0%
Unclassified	No LCC class provided in NRCS Soil Survey for this area	13,445	7%

* The remaining 1% of the study area is comprised of water, made land, and urban land.

Source: USDA Natural Resources Conservation Service, 2015.

Appendix 3. Food Hub Financial Pro Forma Toolkit – User Guide

The project's detailed food hub financial pro forma tool kit is attached to this report as a standalone Microsoft Excel model.

Overall, the project team took a conservative approach to the financial estimates of the food hub business model, using wholesale prices and limiting revenue-generating activities to core hub functions. The corresponding spreadsheet model provides the detailed outputs of these assumptions by year.

In addition, the pro forma model also provides the user the tools to test other market, cost and capital assumptions than those specified in this analysis, such as a shift from wholesale prices or a different mix of crop supply, allowing for customized future applications of the tool. This user guide gives a walk through on how to interpret the detailed financial outputs of the spreadsheet model and how also to conduct a customized analysis using the pro forma tool.

Feasibility Analysis Toolkit User Guide

The project's corresponding financial feasibility analysis tool kit (hereinafter "Tool Kit") is delivered as a Microsoft Excel spreadsheet. The Tool Kit user manual below describes each worksheet in the spreadsheet and the functionality that may be used to customize the analysis for the type of operation envisioned by the user.

OVERVIEW OF THE TOOLKIT SPREADSHEET

The Tool Kit includes the following worksheets:

- Project Life,
- Product Mix Scenarios,
- Years 1-3,
- Year 4 – 2 Lines,
- Year 5 – 2+ Lines,
- Year 6 – 3 Lines,
- Year 7 – 4 Lines,
- COGS and Sales Prices,
- Customer Price Library,
- Op Costs,
- Labor, and
- Capital.

The **Project Life** worksheet is the master pro forma analysis, extending to Year 20 and calculating the key financial indicators such as the annual net operating income (Earnings Before Income Taxes, Depreciation and Amortization - EBITDA) and the Internal Rate of Return (IRR).

The **Product Mix Scenarios** Worksheet provides a place for the operator to model alternate crop mixes and levels of production in the first few years as the project scales up. The **Years 1-3** worksheet summarizes the outcomes of these early scenarios for purposes of inserting the financial data onto the

Project Life pro forma analysis.The worksheets labeled **Years 4 through 7** provide matrices to model crop mixes and levels of production for each operating line as they are added in subsequent years. These worksheets are also tied to the **Project Life** worksheet and feed directly into the main pro forma analysis.

The remaining worksheets provide inputs to the annual operations analyses, including crop prices and finished product sales prices, operating costs by year, labor requirements and costs by year, and capital investments and financing costs, also phased by year.

PRO FORMA ANALYSIS

The **Project Life** worksheet depicts the summary pro forma analysis for the Delta Food Hub. All of the cells in the upper portion of the worksheet are linked to other worksheets related to the various operating years during the development of the Delta Food Hub, as well as to specific worksheets for **labor costs**, **operating costs** and **capital costs**. The user should not enter data directly into any portion of this worksheet except in the table in the lower part of the worksheet labeled **Sensitivity Analysis**. This is described further below.

The revenue generated by the Hub is shown in the upper portion of the pro forma analysis, including gross sales revenue from the operating lines and other revenue from other services, such as produce brokering or technical assistance the Hub staff might provide to other organizations. This line is blank in the Tool Kit spreadsheet.

The expenditures are in the second section of the pro forma in light blue. The **Cost of Goods Sold** (COGS) represents the price paid by the Food Hub to farmers for their raw produce, plus the packaging material costs incurred by the Food Hub. Secondly, labor costs are shown by year and represent a summary of the more detailed costs shown on the **Labor** worksheet. The **Labor** worksheet shows the number of positions employed for each year but generally the amount of production labor needed is a function of the volume of production in each year, which is shown in Row 19 of the worksheet under Operating Characteristics (Total Tons Processed).

Operating Costs consist of facility and equipment rental in the early years, along with maintenance, utilities, and operating supplies. These costs are detailed on the **Op Costs** worksheet.

The difference between revenues and costs for each year is the Net Operating Income, which is calculated by the worksheet and also represented as a percent of sales or revenue.

The Debt Service on **Capital Costs** is calculated at the bottom of the **Capital** worksheet and carried over to the **Project Life** worksheet. These figures represent the annual payments for loans to build the Delta Food Hub facility and to buy major equipment. These costs extend out to year 16 when the building and equipment are projected to be paid off. However, it is assumed the Delta Food Hub operator will be required to fund a portion of the facility construction and equipment with her own cash, or equity capital from other sources. This is part of the amounts shown on the line labeled “Annual Equity Investments.”

In the first few years, however, this line reflects operating capital the Food Hub operator would need to invest to cover initial operating losses. The **Project Life** worksheet begins with year 0 to reflect the initial operating capital needed to start the Food Hub. The figure of $373,434 shown in Year 0 is 50 percent of the amount needed to operate the business in year 1 ($746,868) total expenditures including COGS, labor and operating costs. This provides initial capital to start operations before sales can begin to occur. Subsequent annual equity investments include operating losses for years 2 and 3 and the equity portion of the capital costs, such as land costs and 20 percent of building and equipment costs. These costs continue through year 7 when the full capacity of the facility is developed.

As shown in the figure below, the revenue and expenditure section of the **Project Life** worksheet are tied to the individual operating worksheets by year, until year 8 when they simply carry the stabilized operating level forward.

20 Year Annual Operations – Project Life Worksheet

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue		**$500,500**	**$825,000**	**$1,200,000**	**$4,053,130**	**$8,991,089**	**$11,145,108**	**$16,234,065**	**$16,234,065**	**$16,234,065**	**$16,234,065**
Processing Lines		$500,500	$825,000	$1,200,000	$4,053,130	$8,991,089	$11,145,108	$16,234,065	$16,234,065	$16,234,065	$16,234,065
Add'l Services Revenue											
Expenditures		**$746,868**	**$1,090,950**	**$1,468,337**	**$4,525,479**	**$8,847,463**	**$10,076,804**	**$13,870,394**	**$13,870,394**	**$13,870,394**	**$13,870,394**
COGS (w/pkging)		$423,926	$712,448	$1,036,288	$2,890,908	$6,087,914	$6,898,591	$9,733,142	$9,733,142	$9,733,142	$9,733,142
Labor		$270,952	$324,643	$368,368	$1,024,167	$1,534,788	$1,699,605	$2,097,656	$2,097,656	$2,097,656	$2,097,656
Operating Costs		$51,989	$53,859	$63,681	$610,405	$1,224,761	$1,478,608	$2,039,596	$2,039,596	$2,039,596	$2,039,596
Net Op. Inc. (EBITDA)		**($246,368)**	**($265,950)**	**($268,337)**	**($472,349)**	**$143,625**	**$1,068,304**	**$2,363,672**	**$2,363,672**	**$2,363,672**	**$2,363,672**
Percent of Sales		-49%	-32%	-22%	-12%	2%	10%	15%	15%	15%	15%
Debt Serv. on Capital Costs			**($103,578)**	**($484,660)**	**($541,354)**	**($601,457)**	**($698,523)**	**($744,935)**	**($744,466)**	**($744,466)**	**($744,466)**
Annual Equity Investments	**($373,434)**	**($265,950)**	**($710,908)**	**($664,297)**	**($105,140)**	**($105,531)**	**($169,796)**	**($82,369)**	**$0**	**$0**	**$0**
Net Cash Flow	**($373,434)**	**($512,318)**	**($1,080,437)**	**($1,417,294)**	**($1,118,843)**	**($563,362)**	**$199,985**	**$1,536,367**	**$1,619,206**	**$1,619,206**	**$1,619,206**
Internal Rate of Return								**-24%**	**-9%**	**0%**	**5%**
Operating Characteristics											
Total Tons Processed		300	550	800	2,577	5,154	5,930	7,804	7,804	7,804	7,804
Revenue per lbs		$0.74	$0.75	$0.75	$0.79	$0.86	$0.94	$1.04	$1.04	$1.04	$1.04
COGS per lbs		$0.61	$0.50	$0.50	$0.56	$0.58	$0.58	$0.62	$0.62	$0.62	$0.62
Gross Margin		$0.12	$0.25	$0.25	$0.23	$0.28	$0.36	$0.42	$0.42	$0.42	$0.42
Percent of Sales		14%	33%	33%	29%	32%	38%	40%	40%	40%	40%
Total Cash Investment	$4,502,325										
Operating Capital	$3,290,316										
Capital Investments	$1,212,009										

The net operating income minus the annual equity investments and debt service equal the net cash flow. Under the simplified cost and revenue assumptions built into the spreadsheet, the annual net cash flow turns positive in year 5 and the project begins to show a positive return on investment (Internal Rate of Return - IRR) in year 9, after the full build-out of the facility capacity is complete. As discussed below, these cost and revenue assumptions will need to be more closely evaluated to determine if they are realistic for the planned Delta Food Hub. It takes several years of positive cash flow to recoup the initial investment in the project, which is why the IRR lags behind both the EBITDA and the net cash flow. By year 20 the IRR reaches 19 percent as net revenues are unencumbered by debt service or other capital costs. The Tool Kit is concerned with testing the feasibility of developing and operating the facility, but it does not address an exit strategy for the project. Presumably, the developer/operator could sell the facility once stabilized operations are achieved. The net proceeds from the sales transaction would add to the financial return on the project, but this would require a separate calculation.

The **Project Life** worksheet also summarizes operating characteristics of the project for each year, including tons of produce processed, the revenues and COGS per lbs. of produce and resulting gross margin.

Finally, the **Project Life** worksheet calculates the cash investment required to start the project, labeled Total Cash Investment. The total figure of $4.5 million equals the sum of the Net Cash Flow through year 3. Beginning in year 5, the facility generates a positive net cash flow and can pay for additional capital costs from operating revenues. However, up through year 4, the operator will need to cover the operating losses plus the equity investments needed for capital expenditures. The capital investments include the equity required through year 4 from the Capital worksheet and the operating capital is equal to the balance of the operating losses through year 4.

Underneath the pro forma table in the worksheet is a separate table labeled **Sensitivity Dial**. This allows the reader to test the effects of global changes to any of the revenue or cost categories in the analysis for any of the first 7 years of operation. The default setting for all of these categories is 1.00, meaning that the detailed revenues and costs provided on the individual worksheets for each operating year and cost category are taken at face value. However, if for example the operator suspects that in the early years the Hub may have to pay farmers higher prices due to the smaller volumes, she can increase the COGS by 10% or 20% by inserting a 1.1 or 1.2 in the COGS cells for the first few years. This will have an immediate effect on the **Project Life** worksheet as well as the detail sheet for **Years 1-3**. Similarly, wholesale increases in labor costs or operating costs can be tested in the same way.

If the user has more detailed information about specific cost or revenue changes, this information can be input on the individual worksheets where it applies, as described further in the user manual. As shown in the figure below, the **Sensitivity Dial** allows for quick hypothesis testing on a more global scale.

Sensitivity Dial

Revenue/Cost Component	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Market Sales Prices	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Cost of Goods Sold	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Labor Costs	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Operating Costs	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Capital Costs	1.00	1.00	1.00	1.00	1.00	1.00	1.00

INITIAL YEARS – SCALING UP THE OPERATION

Product Mix Scenarios – Years 1-3

The primary purpose of the **Product Mix Scenarios** worksheet is to allow the user to develop operating scenarios for the first couple years of hub operations (see figure on following page). The default figures in the worksheet reflect the projected year 1 volume of production for the Hub, at 300 tons. As alternate scenarios are developed for year 1 or for subsequent years, the upper portion of the right hand column in the worksheet (cells O5 to O11) can be copied over (using the Excel Paste Special, Values Only function) to the **Years 1-3** worksheet in the appropriate years to adjust the overall project pro forma. The **Years 1-3** worksheet is tied into the **Project Life** worksheet for this purpose. If the user does not need the detailed monthly analysis, then summary annual operating levels can be plugged directly into the **Years 1-3** spreadsheet to model the financial performance during the early years.

Product Mix Scenarios Worksheet, Years 1-3 – 2 processing Lines

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
Revenue		$7,480	$8,893	$33,592	$48,720	$55,902	$59,761	$59,356	$59,938	$62,921	$52,812
Processing Lines		$7,480	$8,893	$33,592	$48,720	$55,902	$59,761	$59,356	$59,938	$62,921	$52,812
Add'l Services Revenue											
Expenditures		$32,359	$34,752	$50,353	$70,512	$76,446	$82,457	$76,555	$76,699	$78,370	$73,154
COGS (w/pkging @		$6,814	$9,055	$23,592	$43,372	$49,231	$54,711	$48,656	$48,952	$50,699	$45,938
Labor		$21,213	$21,365	$22,428	$22,807	$22,883	$23,414	$23,566	$23,414	$23,338	$22,883
Operating Costs		$4,332	$4,332	$4,332	$4,332	$4,332	$4,332	$4,332	$4,332	$4,332	$4,332
Net Op. Inc. (EBITDA)		($24,879)	($25,859)	($16,761)	($21,792)	($20,544)	($22,696)	($17,199)	($16,760)	($15,449)	($20,342)
Percent of Sales		-332.6%	-290.8%	-49.9%	-44.7%	-36.8%	-38.0%	-29.0%	-28.0%	-24.6%	-38.5%
Debt Serv. On Cap											
Net Cash Flow		($24,879)	($25,859)	($16,761)	($21,792)	($20,544)	($22,696)	($17,199)	($16,760)	($15,449)	($20,342)
Operating Characteristics											
Revenue per lbs		$0.53	$0.49	$0.73	$0.87	$0.96	$0.83	$0.78	$0.83	$0.90	$0.91
COGS per lbs		$0.49	$0.50	$0.51	$0.77	$0.85	$0.76	$0.64	$0.68	$0.72	$0.79
Gross Margin		$0.05	-$0.01	$0.22	$0.10	$0.12	$0.07	$0.14	$0.15	$0.17	$0.12
Percent of Sales		9%	-2%	30%	11%	12%	8%	18%	18%	19%	13%
Total Tons Processed		7	9	23	28	29	36	38	36	35	29
Crop Mix for Individual Operating Lines											
Line 1	1										
Revenue		$0	$0	$24,976	$38,427	$46,060	$46,746	$39,909	$39,118	$43,070	$37,367
Loss Rate	92%										
COGS		$0	$0	$10,363	$27,403	$33,547	$35,058	$26,173	$26,299	$29,622	$26,241
Margin Percent				59%	29%	27%	25%	34%	33%	31%	30%
Total lbs		0	0	28,000	32,000	36,000	40,000	42,000	42,000	40,000	34,000
Target lbs Year [1]		0	0	28,000	32,000	36,000	40,000	42,000	42,000	40,000	34,000
Iceberg Lettuce											
Input lbs				4,000	4,000	4,000					4,000
Farmgate Price (per lbs)		$0.00	$0.00	$0.14	$0.17	$0.15	$0.00	$0.00	$0.00	$0.00	$0.40
Market price (per lbs)		$0.00	$0.00	$0.25	$0.22	$0.35	$0.00	$0.00	$0.00	$0.00	$0.41
Green Leaf Lettuce											
Input lbs				4,000	4,000						
Farmgate		$0.00	$0.00	$0.32	$0.46	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Market		$0.00	$0.00	$0.88	$0.99	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Red Leaf Lettuce											
Input Lbs				4,000	4,000						
Farmgate Price (per lbs)		$0.00	$0.00	$0.31	$0.46	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Market price (per lbs)		$0.00	$0.00	$0.88	$0.99	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Romaine Lettuce											
Input lbs				4,000	4,000						4,000
Farmgate Price (per lbs)		$0.00	$0.00	$0.25	$0.37	$0.00	$0.00	$0.00	$0.00	$0.00	$0.57
Market price (per lbs)		$0.00	$0.00	$0.41	$0.54	$0.00	$0.00	$0.00	$0.00	$0.00	$0.61
Spinach											
Input lbs				4,000	4,000	8,000	8,000	8,000	6,000	4,000	4,000
Farmgate Price (per lbs)		$0.00	$0.00	$0.67	$0.34	$0.71	$0.41	$0.42	$0.59	$0.77	$0.66
Market price (per lbs)		$0.00	$0.00	$1.95	$0.69	$0.61	$0.65	$0.68	$0.60	$0.64	$0.65

This worksheet, and the subsequent worksheets for later years, provides the opportunity to vary crop inputs and pricing monthly. The farmgate price and market price for each crop are linked to the **COGS and Sales Prices** worksheet. Any changes in prices should be input to that spreadsheet. In the **Product Mix Scenarios** worksheet, the user need only change the input lbs. for each crop by month to create the overall desired crop mix and level of production.

It should be noted that in the Delta region, not all of the crops appear to have beneficial pricing, in terms of the gross margin offered by the terminal market prices vs. the farmgate prices. This may be a function of poor data available from the Agricultural Market Service, but crops like lettuce, spinach, bell peppers, and celery appear to have such low margins that they do not contribute beneficially to the financial viability of the Hub, at least at the volumes projected in the early years. Other crops have some months where the gross margins are adequate and other months where they are too low. The input volumes for these crops have been eliminated or reduced for certain months in order to show what mix of crops would help the Food Hub get off to a better financial start in its first year. If alternate pricing can be obtained for the deleted crops, or other crops added to the mix, then these results can be improved.

This worksheet includes two operating lines, one for tender produce and one for firmer products. This flows from the design of the permanent facility, which would start operations in year 4, but may not be relevant to operations in the temporary facility during the early years. The worksheet allows the user to "turn off" each line by deleting the "1" in the yellow box on rows 25 and 84.

The row labeled Target lbs. Year [1] should be input manually by the user to match the annual desired production level. This row provides a convenient indicator to judge whether the individual crop input levels are meeting the desired goal on a monthly basis.

The **Product Mix** worksheet has built-in factors for loss rates of produce during processing. For tender produce, it is assumed 92 percent of raw produce is shipped out as finished product for sale (row 27) and for firmer produce the retention rate is 95 percent (row 86). These factors were developed for the analysis of the permanent facility and may need to be adjusted based on actual experience at a temporary facility.

The revenue and COGS w/packaging costs in the upper portion of the worksheet will calculate automatically based on the input lbs. provided by the user. However, the packaging materials costs shown in row 25 of the Years 1-3 worksheet (as shown in figure on following page) are based on the projected volumes from the Food Hub analysis and would have to be adjusted if different volumes are projected by the user. The user can simply overwrite the figures in the **Packaging Cost** row in the **Year 1-3** worksheet if different packaging costs are anticipated.

Start Up and Years 1-3 Annual Operations

	Year 0	Year 1	Year 2	Year 3
Revenue		**$500,500**	**$825,000**	**$1,200,000**
Processing Lines		**$500,500**	$825,000	$1,200,000
Add'l Services Revenue				
Expenditures		**$746,868**	**$1,090,950**	**$1,468,337**
COGS (w/pkging)		$423,926	$712,448	$1,036,288
Labor		$270,952	$324,643	$368,368
Operating Costs		$51,989	$53,859	$63,681
Net Op. Inc. (EBITDA)		**($246,368)**	**($265,950)**	**($268,337)**
Percent of Sales		-49%	-32%	-22%
Debt Serv. On Capital Costs			**($103,578)**	**($484,660)**
Annual Equity Investments	**($373,434)**	**($265,950)**	**($710,908)**	**($664,297)**
Net Cash Flow	**($373,434)**	**($512,318)**	**($1,080,437)**	**($1,417,294)**
Internal Rate of Return				
Operating Characteristics				
Total Tons Processed		300	550	800
Revenue per lbs		$0.74	$0.75	$0.75
COGS per lbs		$0.61	$0.50	$0.50
Gross Margin		$0.12	$0.25	$0.25
Percent of Sales		14%	33%	33%
Packaging Supplies		$88,608	$162,448	$236,288

The labor and operating costs are linked to the cost figures for year 1 in the **Op Costs** worksheet and the **Labor** worksheet. If the user is developing scenarios for Years 2 or 3, the cell references in the **Labor and Operating costs** rows will need to be changed to pick up the year 2 or 3 costs from the **Labor and Op Costs** worksheets, rather than year 1. In the **Years 1-3** worksheet, operating and labor costs for each year are already linked to the proper columns and rows in the Op Costs and Labor worksheets.

The operating expenses in **Years 1-3** include space rent, parking and utilities. There would be additional expenses to rent a forklift and to purchase pallets and containers. For each initial year in the analysis, we assume the facility would need sufficient pallets and containers to hold two days' worth of production volume.

FULL SCALE OPERATIONS

Product Mix Scenarios – Year 4, 2 Lines

The permanent building for the Delta Food Hub would be built in year 3, and be available for operations in year 4. This worksheet is very similar to the **Product Mix Scenarios** worksheet, except that it is connected directly to the **Project Life** worksheet as part of the overall pro forma analysis. The operating and labor costs are linked to the year 4 figures on the **Op Costs and Labor** worksheets, respectively. Based on the Delta Food Hub feasibility analysis, most of the operating costs are figured as a percent of revenue and the packaging costs are calculated at 3.5 percent of the COGS.

This worksheet allows the same ability to vary crop mixes and production levels as does the **Product Mix** Scenarios worksheet.

Product Mix Scenarios – Year 5, 2+ Operating Lines

In year 5, the third operating line, which freezes the product, comes online. We assume in year 5 that most of the crop throughput will be on Lines 1 and 2 while Line 3 provides a deeper processing option as operations scale up. The equipment for Line 3 is flexible and designed to run on either Line 1 or Line 2. In this scenario, Line 3 functions as a "safety valve" for the Food Hub operator, allowing diversion of crops from Lines 1 and 2 and purchase of surplus crops during months when prices are low. Operating adjustments are made on Lines 1 and 2 to keep to the two tons per hour total processing volume. The labor and operating costs are tied to this total volume assumption. In addition, the worksheet has built-in assumptions that a certain percentage of produce culled from Lines 1 and 2 can be diverted to Line 3 for freezing. For each crop on Line 3, there is a row labeled Diverted from Lines 1 & 2. For Line 1 produce the diversion rate is 3 percent while for Line 2 it is 2 percent. These percentages can be changed by the user for each crop type based on actual experience.

Regarding Line 3, there are months in which the finished frozen prices for certain crops are lower than the fresh farmgate price, particularly when factoring in the added loss rate from the freezing process (the frozen weight as a percent of fresh weight is in Column B shown for each crop in Line 3). However, the COGS for the diverted fresh crops are accounted for under Line 1 and 2, so they are assumed to be free in Line 3. Therefore, the farmgate price in Line 3 is a weighted average of diverted produce (at $0/lbs.) and fresh produce (at the normal farmgate price). Even so, we only add fresh purchased produce into Line 3 during months when the blended price is low enough to allow for some gross margin underneath the market price.

The market prices in Line 3 have been adjusted to reflect the difference in retail frozen and fresh prices by crop, and are found in the lower portion of the **COGS and Sales Prices** worksheet. We have assumed that the finished product from Line 3 would be sold during non-harvesting months for each crop, and therefore would command a premium price (but discounted for the fact that it is frozen and not fresh). As a result, the revenues produced from Line 3 occur during different months than the costs of production for each crop. This results in some months showing a negative operating income, but the annual contribution of Line 3 is very positive. The user will need to manually manipulate which months to assume raw product is available for freezing and when it can be sold.

Product Mix Scenarios – Year 6, 3 Lines

This worksheet shows the scenario in which Line 3 is operated at a full one ton per hour and Lines 1 and 2 are not reduced while Line 3 is operating. This results in a throughput of three tons per hour and a total annual processing capacity of 5,930 tons (not counting the 3% of produce diverted from Line 2 to Line 3). This worksheet includes an additional sensitivity analysis section that allows the user to model operations using different combinations of lines (columns P-T). This allows the user to record how each line contributes individually or in combination to the bottom line of the operation. To use this function, turn on the desired line(s) and Copy Paste Values Only from cells O12 and O13 to the appropriate locations in columns P-T. Then turn on a different combination of lines and copy those results in the same way. Columns P-T include every possible combination of Operating Line and the operator can see how different Lines contribute to the overall financial performance of the Hub.

Product Mix Scenarios – Year 7+, 4 Lines

This worksheet shows the result of adding an Individual Quick Frozen (IQF) Line to the other 3 Lines, although we have not added actual commodity data to the Delta Food Hub model. The additional capital cost for this is provided in the Cost Estimate Analysis and is shown in the **Capital** worksheet. With this additional Line, the Hub would operate at 4 tons per hour and process a maximum of 7,804 tons of produce per year. We would assume this Line would use all newly purchased raw product and any diversion of product from Lines 1 and 2 would go only to Line 3, which is also a freezing line. The price structure and operating model for Line 4 would be similar to Line 3. Raw produce would be purchased for Line 4 during months when the crops are plentiful and farmgate prices are relatively low. The finished product would be warehoused and sold during non-peak months at the highest price available for each individual crop. Even so, since Line 4 does not benefit from “free” diversions of produce off the other Lines, the gross margin is lower than for Line 3. Further research is needed to determine to what extent prices for IQF products are higher than for standard frozen products, such as those from Line 3.

This level of operation represents full capacity of the Food Hub as designed in the Cost Estimate Analysis. However, the Cost Estimate Analysis provides capital costs for other types of Operating Lines such as dehydration, aseptic packing for fruit or vegetable purees, boiler systems and other costs for jams and purees. The **Capital** worksheet provides additional cells in year 8-20 to add other capital costs as desired. However, it should be noted that if the number of Operating Lines is expanded, the building itself would also need to be expanded, or a second building constructed to house the additional production capacity. In addition, information about operating costs and pricing would need to be developed and incorporated into the spreadsheet in order to evaluate the financial feasibility and performance of the expanded operations.

REVENUE AND COST DATA

COGS AND SALES PRICES/CUSTOMER PRICE LIBRARY

The Delta Food Hub feasibility analysis used price data from the US Department of Agriculture (USDA), which are shown by month for each crop on the **COGS and Sales Prices** worksheet. Shipping Point (farmgate) and Terminal Market (wholesale) prices are derived from the 2014 Monthly Averages as reported by the USDA, Agricultural Market Service's (AMS) Market News. The prices are reported for typical shipping containers for each type of crop and are converted in the worksheet to uniform prices per pound for use in the pro forma worksheets discussed above. Notes are provided under each crop type section indicating the size of the cartons for which prices are quoted. As the user updates the price information, carton sizes should be checked and the calculation to per pound prices may be need to adjusted if the container sizes vary.

As shown in the figure on the following page, the prices per pound are linked directly to the Operating Line worksheets for **Years 4-7**. If crop types are changed and this sheet becomes re-arranged, it is important to check that the cell references are properly lined up in those worksheets.

Prices are likely to vary across individual farmers to some extent, and across different classes of customers to a greater extent. The **Customer Price Library** worksheet provides a space for the user to collect price data from different types of customers. It is anticipated that institutional customers such as universities, school districts, correctional institutions and hospitals may be an important customer base for the Delta Food Hub. Different price sheets for these customers can be developed on this worksheet and then copied over to the **COGS and Sales Price** worksheet for use in calculating financial returns from selling to different customers. Given the potential complexity of maintaining individual price sheets for multiple customers, this worksheet is not fully developed but simply provides an initial guide and place holder for the user to develop more customized sales price information.

COGS and Sales Prices Worksheet, Years 4-7

DELTA FOOD HUB - FINANCIAL FEASIBILITY TOOLKIT
Monthly Crop Prices for COGS and Sales

Shipping Point and Terminal Market prices are derived from the Monthly Averages as reported by the United States Department of Agriculture, Agricultural Market Service's (AMS) Market News. (*See discussion below)

Shipping Point prices are f.o.b. (free on board) prices that represent open market (spot) sales by first handlers at point of production or port of entry on product of generally good quality and condition.
Terminal Market prices represent sales at first receivers to retailers or other large users of wholesale lots generally of good quality and condition.

LINE 1: TENDER FRESH PRODUCE

#	Crops	Months																							
		January		*February*		*March*		*April*		*May*		*June*		*July*		*August*		*September*		*October*		*November*		*December*	
	Monthly Average Prices, 2014	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*	*Shipping Point*	*Terminal Market*
1	**Leafy Greens**	X	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X	X	X
	Lettuce																								
	**iceberg*					$ 6.91	$ 12.35	$ 8.26	$ 11.17	$ 7.34	$ 17.32									$ 20.21	$ 20.64	$ 31.22	$ 30.19		
	Per Pound					$ 0.14	$ 0.25	$ 0.17	$ 0.22	$ 0.15	$ 0.35									$ 0.40	$ 0.41	$ 0.62	$ 0.60		
	**green leaf*					$ 6.30	$ 17.50	$ 9.21	$ 19.86																
	Per Pound					$ 0.32	$ 0.88	$ 0.46	$ 0.99																
	**red leaf*					$ 6.22	$ 17.50	$ 8.33	$ 19.86																
	Per Pound					$ 0.31	$ 0.88	$ 0.46	$ 0.99																
	*romaine					$ 10.13	$ 16.50	$ 14.62	$ 21.57											$ 22.61	$ 24.40				
	Per Pound					$ 0.25	$ 0.41	$ 0.37	$ 0.54											$ 0.57	$ 0.61				
	Spinach					$ 13.32	$ 39.00	$ 16.71	$ 13.73	$ 14.12	$ 12.22	$ 8.13	$ 13.04	$ 8.38	$ 13.69	$ 11.71	$ 12.02	$ 15.35	$ 12.83	$ 13.14	$ 12.95	$ 12.92	$ 15.71		
	Per Pound					$ 0.67	$ 1.95	$ 0.34	$ 0.69	$ 0.71	$ 0.61	$ 0.41	$ 0.65	$ 0.42	$ 0.68	$ 0.59	$ 0.60	$ 0.77	$ 0.64	$ 0.66	$ 0.65	$ 0.65	$ 0.79		
	Notes:																								
	Lettuce prices are per carton, minimum of 50 lbs.																								
	Spinach prices are per carton, bunched, 20-22 lbs.																								
2	**Brassica Vegetables**	X	X	X	X	X	X	X	X	X	X									X	X	X	X	X	X
	Broccoli					$ 10.78	$ 30.23	$ 11.04	$ 20.31	$ 12.54	$ 17.81	$ 13.10	$ 17.86	$ 8.08	$ 14.26	$ 15.44	$ 20.72	$ 17.63	$ 28.34	$ 11.01	$ 20.28	$ 12.87	$ 21.49		
	Per Pound					$ 0.54	$ 1.51	$ 0.55	$ 1.02	$ 0.63	$ 0.89	$ 0.66	$ 0.89	$ 0.40	$ 0.71	$ 0.77	$ 1.04	$ 0.88	$ 1.42	$ 0.55	$ 1.01	$ 0.64	$ 1.07		
	Kale					$ 9.09	$ 22.71	$ 8.59	$ 23.83	$ 9.05	$ 22.38	$ 7.33	$ 23.47	$ 7.14	$ 19.69	$ 7.35	$ 21.12	$ 9.16	$ 21.29	$ 10.87	$ 22.26	$ 11.49	$ 21.75		
	Per Pound					$ 0.36	$ 0.91	$ 0.34	$ 0.95	$ 0.36	$ 0.89	$ 0.29	$ 0.94	$ 0.29	$ 0.79	$ 0.29	$ 0.85	$ 0.37	$ 0.85	$ 0.44	$ 0.89	$ 0.46	$ 0.87		
	Notes:																								
	Broccoli prices are per 20 lb. carton, loose																								
	Kale prices are per 25 lb. carton, bunched																								

Operating Costs

The operating costs for the facility have been estimated by Foodpro, International based on their facility design (See *Cost Estimate Report* at www.sacog.org/rucs). As shown in the below figure, the projected costs for the early years are shown by line item on this worksheet. In the Delta Food Hub model, we have assumed the variable operating costs can be scaled to the volume of production in the early years.

Non-Personnel Operating Costs Worksheet

Year 1

Annual Costs	**Bldg. Sq.Ft.**	**Lease Rate**	**Monthly**	**Annual**
Building lease, parking and utilities	3,000	$0.55	$1,650	$19,800
Forklift rental			$1,150	$6,900
Truck Rental				$3,250
Subtotal				$29,950

One-time Costs	**Quantity**	**Unit Cost**	**Tax/ Freight**	**Annual**
Forklift battery	1	$3,800	$570	$4,370
Forklift bat. charger	1	$1,400	$210	$1,610
Pallet Jacks	1	$250	$38	$288
Pallets	16	$80	$12	$1,472
Pallet bins	16	$271	$41	$4,977
Plastic crates, collapsible	213	$25	$4	$6,011
Plastic crates, non-collapsible	192	$15	$2	$3,312
Subtotal				$22,039

Year 2 - Additional

Annual Costs	**Bldg. Sq.Ft.**	**Lease Rate**	**Monthly**	**Annual**
Forklift rental			$1,150	$13,800
Truck Rental				$3,250
Subtotal				$17,050

One-time Costs	**Quantity**	**Unit Cost**	**Tax/ Freight**	**Annual**
Pallet Jacks	1	$250	$38	$288
Pallets	7	$80	$12	$613
Pallet bins	7	$271	$41	$2,074
Plastic crates, collapsible	89	$25	$4	$2,504
Plastic crates, non-collapsible	80	$15	$2	$1,380
Subtotal				$6,859

Beginning in year 4, these costs have been converted to percentages of revenue on the assumption that they are generally related to the volume of operations. Equipment maintenance, however, is related to the specific equipment installed in the hub and is tied to the relevant portion of the **Capital** worksheet (row 9). If the equipment inventory is different for the facility planned by the user, this maintenance factor may need to be re-estimated. Any of the operating costs can be revised by changing the dollar costs or percentage factors in the **Op Costs** worksheet.

Labor

As shown in the figure below, the **Labor** worksheet lists the anticipated positions needed to run the Food Hub and provides sections to calculate the labor costs for each year of operation through year 5. Columns B and C show the estimated hourly wages and benefits costs for each position. Then subsequent columns allow projections of staffing for each year of operation. For the first three years, the staffing requirements are expressed in annual hours, since a number of the positions may be filled part time. Starting in Year 4, the positions are expressed as Full Time Equivalents (FTE). The year 5 section allows calculation of labor costs on a weekly or monthly basis, if desired, in addition to the annual estimates.

In the **Operating Line** worksheets, the monthly labor costs are estimated in two sections. The management and professional staff in the upper portion of the **Labor** worksheet are simply divided equally into twelve months. The laborers in the lower portion of the worksheet are estimated based on monthly production volumes, using the labor cost per ton factors in row 34. The analysis assumes that additional management and professional staff are not needed after year 5 but that the production worker labor costs continue to increase with higher levels of production in years 6 and 7.

Labor Worksheet, Personnel by Employment Class

			Year 1		Year 2	
	Hourly Rate	Workers Comp, Benefits, etc. @ 0.40*	Total Annual Hours	Annual Cost	Total Annual Hours	Annual Cost
Management Staff						
Facility/Marketing Manager	$27.00	$10.80	2,080	$78,624	2,080	$78,624
Supervisor	$20.00	$8.00	910	$25,480	1,820	$50,960
Professional Staff/Services						
Buying Agent	$20.00	$8.00	2,080	$58,240	2,080	$58,240
Sales and Marketing	$20.00	$8.00	2,080	$58,240	2,080	$58,240
Bookkeeper	$20.00	$8.00	780	$21,840	1,560	$43,680
Administrative Assistants	$12.00	$4.80		$0		$0
Agricultural Advisor	$20.00	$8.00		$0		$0
Outside Accountant	$60.00		96	$5,760	96	$5,760
Subtotal Mgmt/Prof.				$248,184		$295,504
Skilled Labor						
Operator-Receiving Station	$15.00	$6.00		$0		$0
Truck Driver(s)	$15.00	$6.00	260	$5,460	520	$10,920
Misc. Skilled	$15.00	$6.00		$0		$0
Unskilled Labor						
Full Time Class 1	$12.00	$4.80		$0		$0
Full Time Class 2	$10.00	$4.00		$0		$0
Part Time Class 1*	$10.00	0.1056/$100	1,820	$18,200	1,820	$18,200
Workers Comp Class 1				$19.22		$19.22
Part Time Class 2						
Workers Comp Class 2						
Subtotal Labor			10,106	$23,679	12,056	$29,139
Total Estimated Personnel Costs				$271,863		$324,643
Labor Cost per Ton		Total		$900.21		
		Labor only		$75.89		

Capital

As shown in the figure on the following page, this worksheet contains all the costs associated with building and equipping the permanent Delta Food Hub facility. The first line item is the cost of the site. We have assumed a 35 percent lot coverage ratio, which requires a 1.5 acres' site for the 22,000 sq. ft. building. We have assumed a price of $175,000 per acre, for a total cost $262,500. This is in the range of observed industrial land prices in Yolo and Sacramento Counties, but could vary substantially depending on location. There would be advantages to having more extensive yard space and if the facility were located in a more rural setting, presumably a larger site could be purchased within this budget.

The construction of the permanent facility and the related machinery has been estimated by Foodpro, International (see *Cost Estimate Report* of SACOG's Agricultural Infrastructure Feasibility Analysis, http://www.sacog.org/post/sacramento-region-food-hub). We have shifted some of the early machinery and pallet costs to the **OpCosts** worksheet and also increased the contingency to 10 percent to allow for a performance bond and other insurance during the construction period. The costs have been phased over the 6-year development period. Some of the equipment would actually be purchased in year 2 for use in the temporary building and then moved to the permanent building in year 4.

The worksheet calculates an annual and cumulative grand total construction and site cost and then calculates annual debt service. We have assumed the land would need to be purchased outright and there would be a 20% equity investment for capital purchases, including building and equipment. The assumed financing terms are shown in the box in rows 31-33 and the debt service is calculated in row 29. Under these assumptions, the debt service would continue into Year 16 and the **Capital** worksheet shows the payments, which are also tied into the **Project Life** worksheet.

Capital Worksheet

DELTA FOOD HUB - FINANCIAL FEASIBILITY TOOLKIT
Capital Cost Estimator and Schedule

Cost Investment Category[1,2]	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Costs
Real Estate		$262,500									$262,500
Building Improvements[3]			$1,425,521			$392,000					$1,817,521
Refrigeration			$555,012								$555,012
Processing Equipment		$498,482		$144,966	$245,150	$48,000					$936,598
Other Equipment and Systems[4]		$59,200	$528,490	$275,880	$2,000	$240,000	$328,000				$1,433,570
Produce Handling/Storing Equipment					$175,480						$175,480
Fire Protection			$193,602								$193,602
											$0
Hard Costs Subtotal		$557,682	$2,702,625	$420,846	$422,630	$680,000	$328,000	$0	$0	$0	$5,111,783
Permits and Testing			$153,893	$2,353	$2,113	$3,400	$3,765				$165,524
Engineering (@8% of capital cost)		$260,825		$33,668	$33,810	$54,400	$26,240	$0	$0	$0	$408,943
Construction Management (@5%)			$163,015	$21,042	$21,132	$34,000	$16,400				$255,589
Capital Investment Total		$818,507	$3,019,533	$477,909	$479,685	$771,800	$374,405	$0	$0	$0	$5,941,839
Contingency (@10%)		$81,851	$301,953	$47,791	$47,968	$77,180	$37,441	$0	$0	$0	$594,184
Project Grand Totals		$1,162,857	$3,321,487	$525,700	$527,653	$848,980	$411,846	$0	$0	$0	$6,798,523
Cumulative		$1,162,857	$4,484,344	$5,010,044	$5,537,697	$6,386,677	$6,798,523	$6,798,523	$6,798,523	$6,798,523	
Estimated Equity Investment		$442,571	$664,297	$105,140	$105,531	$169,796	$82,369	$0	$0	$0	$1,569,705
Debt-Financed Capital Costs		$720,286	$2,657,189	$420,560	$422,123	$679,184	$329,476	$0	$0	$0	$5,228,818
Cumulative		$720,286	$3,377,475	$3,798,035	$4,220,158	$4,899,342	$5,228,818	$5,228,818	$5,228,818	$5,228,818	
Estimated Debt Service Costs[5]		$103,578	$484,660	$541,354	$601,457	$698,523	$744,935	$744,466	$744,466	$744,466	

Finance Interest Rate:	7%
Fees:	1%
Loan Amortization Period (yrs):	10

Appendix 4. Food Hub Scenario Crop Production Acres to Supply Year 7 Operation Input

	UF CROP TYPE	FOOD HUB INPUT CROP	YEAR 7 Input lbs	Tons for Facility	Wt. avg. Farmgate price	Production Acres Needed
Line 1	Lettuce - Iceberg	Iceberg Lettuce	170,000	85	$0.26	5.3
	Lettuce - Leaf	Green Leaf Lettuce	60,000	30	$0.39	8.6
	Lettuce - Leaf	Red Leaf Lettuce	60,000	30	$0.39	8.6
	Lettuce - Iceberg	Romaine Lettuce	120,000	60	$0.40	3.8
	Small Farm Leafy Greens	Spinach	725,000	362.5	$0.46	38.2
	Broccoli	Broccoli	1,500,000	750	$0.61	112.1
	Small Farm Leafy Greens	Kale	830,000	415	$0.35	43.7
	Tomatoes - Fresh Market	Tomatoes	820,000	410	$0.37	31.5
	Peppers - Fresh	Bell Peppers	270,000	135	$0.59	6.0
	Blueberry	Blueberries	25,000	12.5	$4.89	2.5
	Strawberry - Fresh	Strawberries	545,000	272.5	$1.69	24.8
	Raspberries	Raspberries	72,000	36	$2.87	3.6
	Peaches - Fresh Market	Peaches	70,000	35	$0.80	2.3
Line 2	Potatoes - Fresh	Potatoes	925,000	462.5	$0.20	18.5
	Celery	Celery	540,000	270	$0.19	8.1
	Small Farm Root Vegetables	Carrots	1,400,000	700	$0.38	66.7
	Sweet Potato	Sweet Potatoes	500,000	250	$0.55	19.2
	Onions	Onions	360,000	180	$0.18	7.5
	Apples - Fresh Market	Apples	175,000	87.5	$0.66	9.7
	Pears - Green Bartlett	Pears	120,000	60	$0.59	2.7
Line 3	Potatoes - Fresh	Potatoes	580,000	290	$0.19	11.6
	Broccoli	Broccoli	500,000	250	$0.53	37.4
	Peppers - Fresh	Bell Peppers	350,000	175	$0.47	7.8
	Blueberry	Blueberries	44,350	22	$3.58	4.4
	Strawberry - Fresh	Strawberries	300,000	150	$1.42	13.6
	Raspberries	Raspberries	43,000	22	$2.81	2.1
	Peaches - Fresh Market	Peaches	150,350	75	$0.72	5.0
	Apples - Fresh Market	Apples	447,350	224	$0.50	24.9
Line 4	Potatoes - Fresh	Potatoes	700,000	350	$0.19	14.0
	Broccoli	Broccoli	1,310,000	655	$0.53	97.9
	Peppers - Fresh	Bell Peppers	745,000	373	$0.42	16.6
	Blueberry	Blueberries	50,000	25	$3.60	5.0
	Strawberry - Fresh	Strawberries	980,000	490	$1.50	44.5
	Raspberries	Raspberries	60,000	30	$2.53	3.0
	Peaches - Fresh Market	Peaches	90,000	45	$0.70	3.0
	Apples - Fresh Market	Apples	90,000	45	$0.61	5.0

Source: SACOG Delta Food Hub Pro Forma (2016)
SACOG Agricultural Cost & Return Model (based on UCCE & ANR Cost and Return Studies)